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ESSEX INSTITUTE.

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ON THE OLDER FORMS OF TERRA-COTTA
ROOFING-TILES.¹

BY EDWARD S. MORSE.

IN tracing out the ethnic relations of past races and the lines pursued by them in their migrations, the material to be studied consists not only of the actual remains of man, but also of the objects and results of his handiwork. If the objects have written characters upon them, the story to be unravelled is often easy; the very style of ornamentation betrays their relationship. Of great value to the archæologist are the enduring objects in stone, metal and terra-cotta. It will be found that those features which pertain to the households of a race, and which are successively taught from father to son, or from mother to daughter, such as methods of shooting the arrow or of weaving, are longest persistent.

In language, it is found that those words which have the deepest root often refer to acts of domestic life which pre-

¹ This paper was communicated to the Essex Institute, Dec. 21, 1891. It afterwards appeared as a series of papers in the *American Architect and Building News*. To the courtesy of Ticknor & Co., the publishers of that journal, the Essex Institute is indebted for the use of the illustrations in this communication.

eminently belong to the family. This fact holds good with regard to the house, and, as we see, the persistent adherence century after century to the same kind of house by migrating tribes, under widely varying climatic conditions, attests to this truth. In studying the origin of Egyptian or Grecian art, the inquirer finds his quest abruptly ended at the line dividing the imperishable stone structure from the perishable mud or wooden one that preceded it. The perishable wooden roof, however, often has associated with it a covering which is the most lasting. Rock crumbles, metal oxidizes, but the rudest earthenware is imperishable, and so the terra-cotta roofing-tiles are often the only surviving relic of a house structure. Furthermore, these objects, being always associated with the house, are intimately identified with every roof-covered family. The persistence of certain types of roofing-tiles among peoples shows the fixedness of a habit. It is a noteworthy fact that the earliest type of terra-cotta roofing-tile ever exhumed still forms the roof-covering of the greater mass of mankind to-day. The enduring nature of these objects will ultimately enable one to trace the paths followed by tile-making races in their various migrations. Wherever the Romans went, the typical Roman tile may be found, often impressed with the stamp of some Roman Legion.

Realizing the imperishable nature of roofing-tiles, and the fact that they are scattered all over the world, it has seemed to me that an inquiry into the various types of terra-cotta roofing-tiles and their geographical distribution might be of value. Unfortunately for the American student, the material to be studied is confined to the Old World, and one must go there for the purposes of investigation.

It would be an interesting inquiry to learn at what time, and where, roofing-tiles were first used. When the earliest hut-builder learned the art of sloping his roof, and

superadded to this achievement the lapping of sheets of bark, or palm-leaves, one over the other, as a rain-shield, the first steps were taken which were to lead to the roofing-tile. That the roofing-tile has a considerable antiquity is certain. Its appearance in Greece dates back to the earliest dawn of Greek art, and yet before this, in Asia Minor, there was a time when the tile was not. Schliemann, in his great work, "*Ilios, the City and Country of the Trojans*," in describing the relics found in the ruins of the first prehistoric city of the hill of Hissarlik shows the almost universal use of pottery by the people. Utensils for every-day life, terra-cotta funeral urns, large terra-cotta bowls, weights for their fishing-nets, handles for their brushes, and even hooks to hang their clothes upon were all made of pottery. "Thus we cannot be astonished in finding in the *débris* of their cities such large masses of broken pottery among which, however, there is no trace of tiles" (p. 214). He infers from this that the flat roof which is found to-day in that region prevailed at that time. Dörpfeld, in a memoir on the origin of the Doric style (a translation of which, by Mr. Edward Robinson, was published in the *Technology Architectural Review*, Vol. III, Nos. 2 and 3), says it was the invention of the terra-cotta roofing-tile that first made the construction of a sloping roof possible. It is probable that the roofing-tile was introduced into Greece from the East, fully developed, and with its introduction the roof, which had before been flat, could now be made sloping. The sloping roof must have preceded the roofing-tile by many thousands of years; at the outset, bark, straw, thatch, rough stones and similar substances were used until better devices were made, which finally culminated in the terra-cotta roofing-tile, the oldest known type of which is, by far, the most common form of roofing-tile in the world to-day.

The antiquity of the sloping roof is hinted at in the finding of cinerary vessels in the form of huts, and consequently known as hut urns. These have been found in Italy, Saxony and other parts of Europe. It is believed that they were made before the age of iron in their respective places. It is interesting to observe that all of them show, not only a sloping roof but a thatched roof as well, with

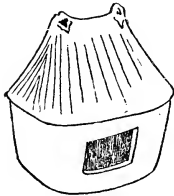


FIG. 1.



FIG. 2.

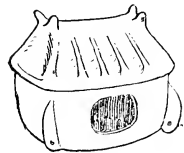


FIG. 3.

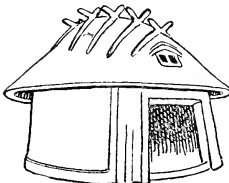


FIG. 4.

Figs. 1-3. Hut urns from Saxony in Museum für Völkerkunde, Berlin.

Fig. 2. In Vatican Museum, Rome.

Fig. 4. From Alba Longa. A better figure is given in Dennis's "*Cities and Cemeteries of Etruria*," Vol. 1, p. lxix.

the characteristic cross-pieces on the ridge, a feature of the thatched roof which may be seen to-day in every part of the world (figs. 1, 2, 3 and 4).

The sequence in the development of the roofing-tile will have to be studied in Asia Minor, or more probably in China. From the high development and great antiquity of the fictile art in China, and the early and artistic development of the tiled roof in that country, one might be led to believe that in China—the ancestral home of so many arts—the roofing-tile originated. Graeber, in a

memoir to be referred to later on, describes what he believes to be the earliest known terra-cotta roofing-tiles. These were found in the ruins of the Temple of Hera, at Olympia, dating nearly a thousand years before Christ. This ancient tile consists of two elements, a wide under

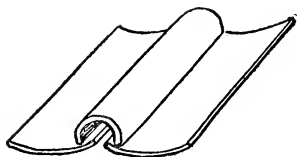


FIG. 5.

piece (tegula) slightly curved, and a narrow, semi-cylindrical piece (imbrex) which was placed in an inverted position so as to cover the junction of two adjacent tegulae (fig. 5).

Of significance, also, is the statement that the open end of the imbrex, where it bordered the eaves, is closed by a circular disk, ornamented in rosette pattern. To find the counterpart of this we have to go to Korea and Japan and, presumably, China. Fortunately, the varied tastes of the Japanese collector have led to the treasuring-up of old roofing-tiles, either for their antiquity or because they were associated with some famous temple. In Japan, one may often see an old tile that has been dug up utilized for an ink-stone. Ninagawa, the famous Japanese antiquarian, contemplated the publication of an illustrated work on ancient roofing-tiles, to form one of the numbers of his "*Kwan ko dzu setsu.*" The lithographic plates were prepared for this number; whether the text was ever published I cannot say. Fortunately securing a set of these plates, I managed to get from the author, some years before his death, the names and dates of the tiles figured. As to the ages attributed to these there may be some doubt, but that some are Korean is a matter easily established by an expert in pottery, as the clay at once reveals the origin of the piece. Some of these were believed by Ninagawa to

be from eleven to twelve hundred years old. One is said to have come from Asiatic Turkey and to be two thousand years old. It is interesting to observe that the tiles are not only large and massive, but that those made for bordering the eaves have widened margins, variously decorated, generally in scroll pattern, and the joint tile, or imbrex, as it is to-day in China and Japan, has one end closed by a circular disk, and what is very interesting in these ancient tiles is that, in nearly every case, the decoration is that of a rosette pattern! The following figures (figs. 6 and 7) are roughly sketched from the plates in



FIG. 6.



FIG. 7.

question with their identifications as given by Ninagawa. The tiles are in every case very thick, and roughly made; in many instances the under surface bears cloth-mark impressions. Furthermore, all the specimens figured whether from Japan or Korea belong to the normal form of tile, with curved tegula and semi-cylindrical imbrex. This is the earliest form of tile known to the Japanese, and tiles of this kind are called by them *Hongawara* or true tile. This form of tile is to-day the common form of tile in Korea, China, Cochin China, India, as well as in all those countries bordering the Mediterranean. When found far-

ther north in Europe it is usually to be seen on the older buildings and is the tile most often seen depicted in mediæval paintings of places outside of Belgium and Holland.

If this form of tile really represent the earliest type, one might readily believe that its form was derived from sections of bark which must have come early into use as a roof-covering. In lapping the sections of bark from the eaves to the ridge, the concave as well as smooth surface, would be placed uppermost as forming the best water gutters. Other sections of bark, perhaps from smaller trees, would have been used to cover the joints of the larger pieces and these would have been placed with their convex surfaces uppermost. Such surmises are quite justifiable when one sees so many forms of pottery whose shapes have been derived from natural objects, as shown in the Pitt-Rivers collection in the Ethnological Museum at Oxford. [Professor Tylor, its director, has brought out in a striking manner similar relations in other departments of the collection.] In other museums, notably the museums in Stockholm and Copenhagen, the change from stone to bronze and iron shows successive derivations of form from objects first made in a ruder material or from natural objects.

As the origin of roofing-tiles is probably not lost in a very dim past, philology may throw some light on the subject. The material of which they are made is among the most enduring of man's fabrications and the earliest form must sometimes be found.

The arrangement of feathers on a bird in shedding the rain would have given a sufficient hint for the proper arrangement of material on a sloping roof. From the rough natural substances used in the prehistoric roof there came, not only slabs of wood, flat pieces of stone, terra-cotta tiles of many kinds, but worked marble tiles (620 B. C.)

modelled after the terra-cotta tile, small bronze tiles in Pliny's time, thin cleavages of slate, continuous sheet-metal roofs and metal sheets modelled after the forms of interlocking tiles.

As to the relative merit of these various roof-coverings I am not prepared to speak, nor is it with any intention of urging the economic value of this material that this paper is prepared; it seems, however, that the terra-cotta tile roof, when properly made is, all things considered, one of the cheapest and most durable. It is certainly one of the oldest and widest distributed.

Definitions.— At this point it becomes necessary to define the different types of roofing-tiles now in use. Leaving out of consideration all forms of interlocking tiles, and recent modifications of the prevailing types now so well known, we find among the older forms three distinct types.¹

The earliest form of roofing-tile known consists of two elements, a wide tile (*tegula*) either square or rectangular, more or less curved in section, and a narrow semi-cylindrical tile (*imbrex*) usually slightly tapering at one end to fit into the wider opening of the one adjoining. The *tegula* is placed on the roof, concave face upward, and the *imbrex*, placed concave face downward, covers the lateral joint between two adjacent *tegulae*. I have not been able to learn of any special English name for this tile; in Germany, it is known as the hollow tile. From the fact that it is the earliest known tile, Graeber, in his exhaustive discussion of the

¹ It would be interesting to clear up the nomenclature of roofing-tiles as some confusion exists through the same name being applied to different forms of tiles, thus the latest dictionary—"The Century,"—almost encyclopædic in its character, gives under the definition of crown tile the English interpretation thus: "I. A flat tile, a plain tile. II. A large bent tile or arched tile usually called a hip or ridge tile, etc." These tiles are in reality two entirely different forms of tiles and neither could be used for the purposes of the other. The synonymy would have to be worked out by some student on the ground and versed in the subject.

varieties of roofing-tiles in ancient Greece and adjacent countries, uses the name of normal tile for this form. The varieties of this tile and the different ways of using it may be designated in *this* paper as follows: When the tegula is used as an imbrex, as in China and India, it may be called the normal tile (*teg.*) When the imbrex is used as tegula, as in Mediterranean countries, it may be mentioned as normal tile (*imb.*) the ancient Grecian and Roman modification as normal tile (*flat*). The pan tile is one having a double flexure forming in section the letter *∞* and is known in some parts of Germany as the S-tile. This tile is an evident adaptation from the normal tile in combining the two elements imbrex and tegula in one piece. Originating in Belgium or Holland, one can easily conceive a thrifty and frugal people devising an economy of handling in making one piece serve the purposes of two.

The flat tile, or, as it is known in England, the plain tile, has no genetic relation to the other forms of tiles. It is simply a shingle in terra-cotta. It is rectangular in shape, flat, often secured to the roof by nailing, and used, as shingles are used, on the vertical side of a house. In roofing, the tiles are adjusted precisely as wooden shingles are by lapping and breaking joints. The German name, flat tile, will be retained as being more descriptive and probably having priority.

The following outlines (fig. 8) represent in a general way the types and varieties of roofing-tiles with their distribution. It should be understood that colonies past and present of these respective countries, so far as I know, adhere to the form of roofing-tile of the parent country. As an illustration, the few evidences of ancient roofing-tiles in this country trace the flat tile; discovered by Mr. E. A. Barber in Pennsylvania, to German settlers; the pan tile,

discovered by Dr. C. C. Abbott on Burlington Island, Delaware River, on the site of an old Dutch House, to Dutch settlers; and, in California, the normal tile (*imb.*) to the old Spanish Jesuits.

It should also be stated that, on the borders of countries using different tiles, the tiles intermix; thus France along

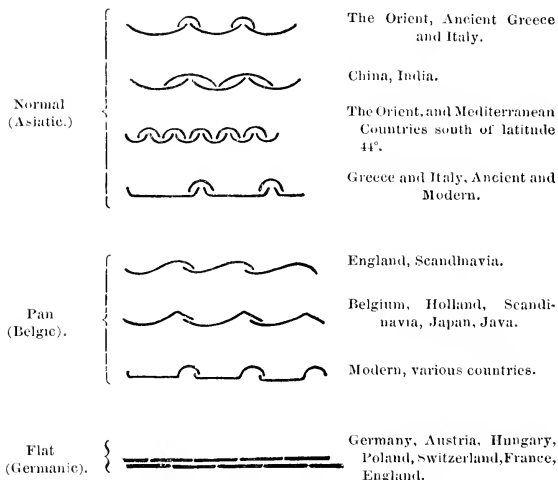


FIG. 8.

the shores of the Mediterranean uses the normal tile (*imb.*); and on German territory, contiguous to Belgium and Holland, the pan tile is often seen.

It will also be found that water-ways have led to the wide dispersion of roofing-tiles, and the occurrence of the pan tile in Poland is probably due to the distribution of this tile along the shores of the Baltic, as the normal tile (*imb.*) is found bordering both shores of the Mediterranean.

CHINA.

China exceeds all other countries in the world in the skill shown in the use of the roofing-tile. Moreover, China, with Korea and Japan, has treated the tile in an artistic

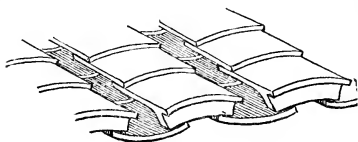


FIG. 9.

way as no other countries have done, except ancient Greece and Rome. The normal tile is universally seen as a roof-covering from Peking through Cochin China and Anam to the Malay peninsula.

The tiles are utilized in a variety of ways as a decorative feature for the roof. Massive ridges are made of them ;

even gateways of common country houses will have a heavy ridge of tiles. Around Shanghai, these ridges are formed by broad, flat tiles placed on end and packed close together like books on a shelf. At the ends of the ridge they are held up by what appears to be an upturned sheet of metal. In the native city of Shanghai, a small, square, slightly-curved tile is used the same answering for

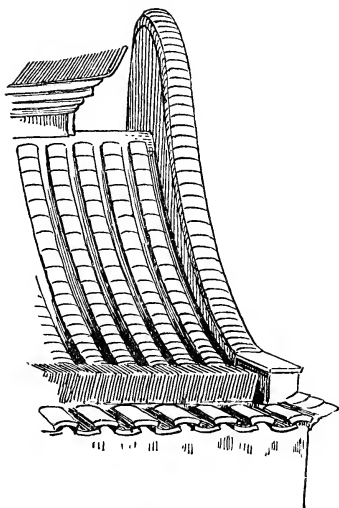


FIG. 10.

tegula and imbrex. The eaves tile has a flange below ; in some cases the under course of eaves tile is simple (fig. 9)

while in other cases both tegula and imbrex bordering the eaves have flanges. In the Shanghai house the wall projects slightly above the eaves, and upon this the tiles are placed on end as above described. Outside this is a cornice of tiles terminating in eaves tiles (fig. 10). On the ridge the tiles, placed on end like books, incline from the middle to both ends of the ridge. They do not appear to be attached in any way. Farther south, at Hong Kong

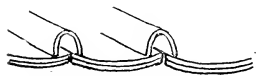


FIG. 11.

and Canton, the eaves tiles are usually simple. At Hong Kong the imbrex is narrow and arch-shape (fig. 11), the eaves having two layers of tegulae without margin, and the imbrex open. The ordinary Pekin tile has a nearly square tegula, 22 centimetres wide, slightly bent and quite thin. In the eaves tiles, both in imbrex and tegula, the disk and margin are made separately in a mould, and afterwards attached to the tile proper. These portions have flowers and other decorations in relief. The tile portion is

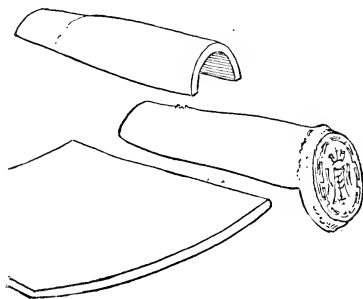


FIG. 12.

evidently made by rolling the clay into a thin sheet and then cutting out pieces of proper dimensions for the imbrex and tegula, and bending them over forms of the required shape. Fig. 12 represents specimens from Pekin

in the museum of the Peabody Academy of Science, Salem. Fig. 13 is figured from specimens of Pekin tiles in the Museum of Fine Arts, Boston. Fig. 14 represents tiles in the Summer Palace at Pekin ruthlessly destroyed by the British. These are sketched from specimens in the South Kensington Museum. Figs. 13 and 14 are glazed a light bluish-green.

A work entitled *Illustrated China and its People*, by J.

Thompson, contains some conspicuous examples of Chinese architecture, notably the Tienhon-kung or "Queen of Heaven Temple" at

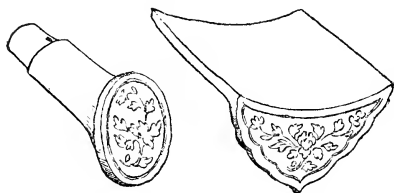


FIG. 13.

Ningpo. This wonderful structure as well as certain monumental buildings in and about Pekin, as, for example, the sacrificial-hall at the tomb of Yung-lo and the Bronze Temple at Pekin, and structures at Canton and elsewhere, all show the use of the normal tile, the eaves tegulae in

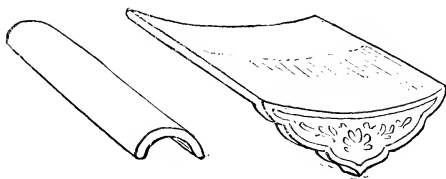


FIG. 14.

some cases having very long and pointed margins, with edges scalloped. The Imperial College, Pekin, is tiled after the style seen at Shanghai (that is, with tegula used as imbrex), but with wide, and flaring margins on the

eaves tiles, the imbrex in this case having a supplementary flange, which flares above (fig. 15).

Photographs of streets in Peking show a roofing-tile not unlike the usual form seen in Shanghai. A modern tile

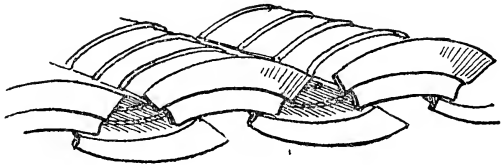


FIG. 15.

of hard, white stone-ware, richly glazed is said to be Chinese. It is a modern production (fig. 16), in Museum of Fine Arts, Boston.

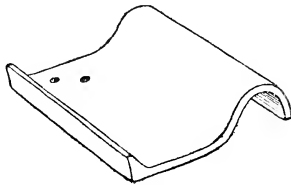


FIG. 16.

COCHIN CHINA.

In the Colonial Exhibit at the Paris Exposition, a building was erected representing a type of the Cochin China house, in fact the entire building was brought from Tonquin. The roofing-tiles as shown in this structure differed in no respects from those found in China proper (fig. 17).

KOREA.

The notes concerning the roofing-tiles of Korea, I gather entirely from Mr. Percival Lowell's interesting work entitled *Chosön. The Land of the Morning Calm*. From

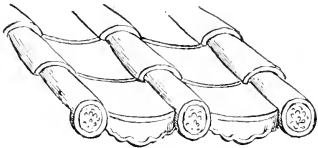


FIG. 17.

the illustrations of this book, reproduced from photographs made by its accomplished author, I am able to present the accompanying figures.

The Korean roofing-tile is of the normal type and is derived directly from China. In the common houses and shops there is no attempt at architectural effect in the way of a heavy or ornamental ridge, though a simple tiled ridge is seen on all the buildings, neither are the eaves tiles different from the others except that the tegulæ are often doubled at the eaves. The end of the imbrex is simply closed with white plaster (fig. 18.)

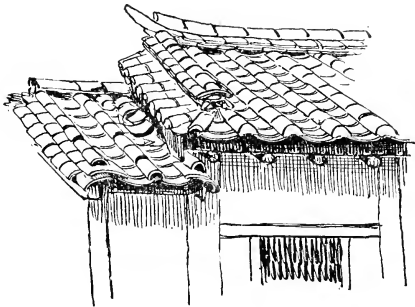


FIG. 18.

On the better class of buildings, especially certain pavilions in the new palace grounds, the eaves tegulæ have

widely turned margins which are also flaring, projecting at such an angle as to hold the snow, as shown in one of the photographs. This expanded margin has a simple design in relief. The imbrex is also closed by an oval disc, with

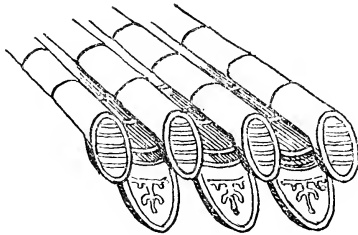


FIG. 19.

a simple design in relief. The oval form of the disc is produced by its diagonal position on the semi-cylindrical imbrex (fig. 19). In a collection of photographs taken by Mr. Lowell, and not published in his book, other forms of eaves tiles are shown associated with pavilions in the Em-

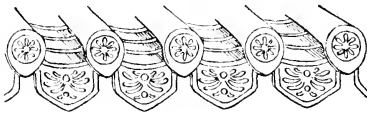


FIG. 20.

peror's grounds. One form is represented in fig. 20. In some buildings a few of these peculiar tegulae decorate the eaves for a few courses from the corner of the roof only, while the remaining portion of the eaves show simple tegulae. The ridge is also a more conspicuous structure than is seen on the common buildings, though not approaching the Japanese tiled ridge in size or complexity. The end of the ridge terminates in an inverted eaves tegula with broad, turned margin.

It is a curious commentary on the shiftless and poverty-

stricken ways of the people to observe in one of the main streets of the capital, awkwardly-shaped thatched roofs in juxtaposition to simple tiled ones.

Korean roofing-tiles are bedded in mud and clay as is the custom in Japan. Fig. 21 is reproduced from a tracing

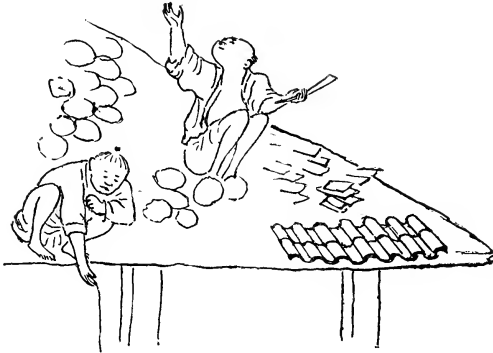


FIG. 21.

made from a native Korean drawing in the National Museum in Washington. This sketch represents Korean tilers engaged in tiling a roof. One is occupied in drawing up the tiles by means of a rope, while another is catching balls of mud or clay which are being tossed up to him from below.

JAPAN.

The form of roofing-tile varies in different parts of Japan. In the southern part the normal tile (*imb.*) is in common use, the pan tile (Yedo tile) is also commonly seen. In Tokio the normal tile reveals along the

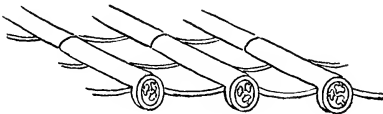


FIG. 22.

eaves either a simple tegula or one with turned margin,

with decoration in relief; the eaves imbrex is always closed by a circular disc having in relief the Tokugawa crest, or the crest of some Daimio (fig. 22). An eaves imbrex is shown in fig. 23. The usual tile in Tokio, as well as in



FIG. 23.



FIG. 24.

Kioto, is a slight modification of the pan tile known as the Yedo tile. This tile like the Belgian form has one curved and one flat surface. The tiles of this kind bordering the eaves have, in one form, the plain flange, the lower edge of which, instead of following the curve of the tile, is straight (fig. 24). Fig. 25 represents a roof covered with this form of tile. In the usual form of this tile, however, the eaves tile carries upon it an

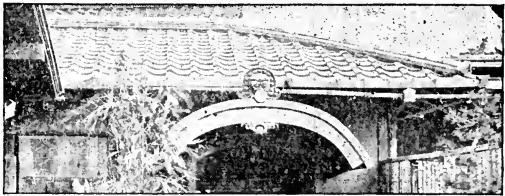


FIG. 25.

imitation of the eaves normal tile, the circular disc of the imbrex portion projecting beyond that portion representing the tegula (fig. 26). In Nagasaki the pan tile bordering the edge of the gable is bent abruptly downward.

It may be observed as a curious feature that in Japan the pan tile laps to the left as seen from the ground, while in all other countries, with rare exceptions, it laps to the right. (Here is added another of the curious instances of reversal which some writers seem to be so fond of connoting.)

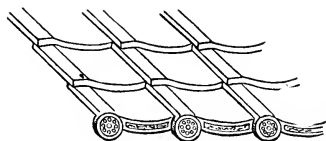


FIG. 26.

The temples and castles in Japan are usually covered with the normal tile.

When the roof is covered with metal, as is often the case, rounded ribs are introduced to carry out the appearance of the ridges made by the imbrices, even to the circular discs and turned margins at the eaves. In the province of Iwami a simple pan tile is made having a glazed surface. A glazed ridge-tile



FIG. 27.

is also made in this province, angular in section, so as to rest like a saddle on the roof (fig. 27A).

Two hundred years ago a pan tile, brown glazed, was made in the province of Bizen. A temple at Uyeno in Tokio, burned at the time of the Revolution in 1868, was covered with these tiles (fig. 28). The Tokio tile is made of a dark gray clay, smooth, and presenting a nearly black surface; it is quite thick though light.

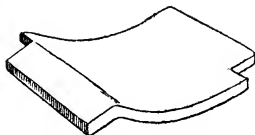


FIG. 28.

I know of no roofing-tile that approaches the Japanese tile in perfection of finish: they are also much higher priced than any other tile known

to me. In comparison, the Chinese tile seems roughly made, is thin, and often warped. The India tile is equally poor in workmanship. So accurately made are the Japanese tiles that roofs may be seen covered with a broad, slightly curved tegula, no imbrex being used (fig. 29). These tiles, like all Japanese tiles, are bedded in mud, and in this instance the edges of the tiles are so straight as to meet together quite perfectly. Simple tegulæ are often used as ridge-tiles on a thatched roof (fig. 27B).

In the better class of tiled roofs it is customary to point with white plaster a number of courses of tiles from the

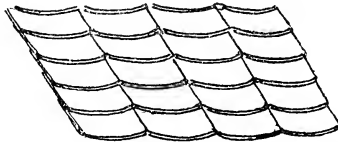


FIG. 29.

ridge, the hip and the eaves, and in some cases the whole tiled surface is treated in this way.

The Japanese ridge is often a very complex and remarkable structure, sometimes of ponderous proportions, with supplementary ridges running down on the hips, and even diverticular ridges near the eaves. These are, or ought to be, built up of tiles and plaster, but oftentimes the bulk of the mass is made up of a carpenter's device consisting of a framework covered with boards, the sides plastered white and having all the appearance of a solid mass of plaster and tiles (fig. 30). The terminal ridge-pieces are often marvels of the tile-maker's art.

Mr. Kashiwagi, a Japanese antiquarian of Tokio, told me that he had records of green-glazed roofing-tiles of the

normal type being used in Japan over a thousand years ago; whether made in Japan or imported is not known. Ninagawa figures in his work on Japanese pottery fragments of what he considered the first glazed pottery made in Japan, and these show a green glaze.

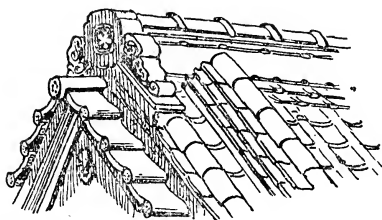


FIG. 30.

In the following figures are shown, by way of comparison, a Japanese (Nagasaki) tiled roof (fig. 31) and the roof of the Temple of Hera, at Olympia (fig. 32), as restored by Graeber. The terminal ridge-tile, the imbrex closed by a circular disc (not, however, represented in fig. 31), the plain tegula at the eaves with simple margin,

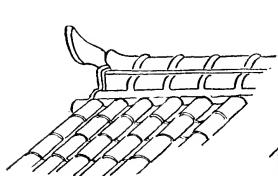


FIG. 31.

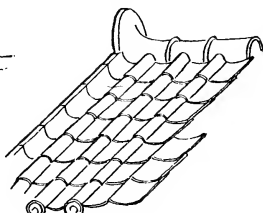


FIG. 32.

present striking resemblances between roofs separated by nearly three thousand years in time and thousands of miles in space. (For further information regarding tiled roofs in Japan see Morse's *Japanese Homes and their Surroundings*.)

INDIA.

So far as museum specimens and photographs have enabled me to judge, the roofing-tiles used everywhere in India are of the normal type (usually *imb.*). Judging by the form of the imbrex as shown in photographs of Bombay houses, it would seem that in their manufacture a tapering cylinder of clay is turned on a potter's-wheel, and then cut in halves longitudinally, and these halves are used as tegula and imbrex. As an evidence of this, in the Bombay roof the tiles bordering the eaves terminate as cylindrical tiles, the tapering end entire and projecting slightly beyond the eaves, while the larger end is cut half-way through to accommodate the overlapping and inverted tiles

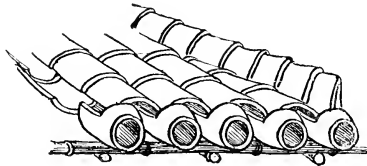


FIG. 33.

that cover the under courses, as shown in fig. 33 (sketched from a photograph in the India Museum, London).

In Madras the normal tile (*teg.*) is used. In some cases the eaves have two thicknesses of tegulae below and three above (fig. 34). The tiles used at Poona, near Bombay, are a variety of the normal type (fig. 35), the tegulae being flat with upturned edges.

This tile is 23 centimetres long; the exposed edge is 14 centimetres wide and tapers rapidly to a width of 9 centimetres, with rounded ends. The imbrex is semi-cylindrical, 28 centimetres long, 10 centimetres across at the exposed end, and tapers to a width of 6 centimetres.

These tiles are light-colored, porous, and very roughly made. The specimen figured is in the great Indian collection made by Dr. Jagor, now in the Museum für Völkerkunde, Berlin. From a few photographs that I have seen of Indian houses there seems to be no modification of the eaves tiles for architectural effect.

The English buildings in Agra and an English church in Bombay, and doubtless English buildings in other parts of the empire, are covered with the ordinary pan tile.

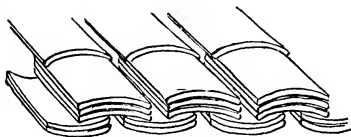


FIG. 34.



FIG. 35.

CEYLON.

At Columbo the normal tile (*imb.*) is seen, the eaves tile having a double imbrex. At Candy, the famous temple is roofed with flat tiles having square ends, presenting in the photograph the appearance of a shingled roof. Other buildings near the temple are covered with the normal tile (*imb.*).

PERSIA.

Judging by the few pictures and descriptions available, the normal tile (*imb.*) seems to be the one in common use. In former times, judging by the high skill attained by the

Persians in brick enamelling, and the wonderfully glazed, flat tiles for interior decoration, the palaces and mosques must have presented a most beautiful and brilliant appearance. In the article "Tiles" in "*Encyclopædia Britannica*," it is stated that the roofs of some of these important structures "are covered with magnificent, lustrous tiles decorated with elaborate painting, so that they shine like gold in the sun. They were especially used from the thirteenth to the fifteenth century." From this statement one gets no idea of the form of tile used.

The high attainment reached in relief work and colored enamels by the early Persians may be seen in the wonderful wall made of brick brought back from Persia by M. Dieulafoy, and displayed in a special room at the Louvre. On this wall are depicted in colored enamels a number of archers, known as the Susa archers.

TURKEY.

Photographs of buildings in Constantinople and other places show the universal use of the normal tile (*imb.*); the semi-cylindrical ridge-tile accompanies it. The Constantinople tile seems slightly more angular in section than that of Italy.

SYRIA.

In Jerusalem and Jaffa, the normal tile (*imb.*) seems the only roofing-tile in use. The joints between the tiles are often pointed with plaster.

EGYPT.

When a tiled roof is seen, it is covered with the normal type (*imb.*). The courses are laid close together, as in the modern Greek roof, and, as in the Greek roof, the interstices between the tiles at the eaves are filled with plaster.

GREECE.

The normal tile is the only form seen in Greece and the adjacent islands. The usual narrow form (*imb.*) common to the Mediterranean countries is also the prevailing form in Greece. In many instances the two elements of the tile are less cylindrical than those of Italy. Greece is the only country in Europe in which the broad, curved tegula with narrow imbrex is seen. In Eleusis, roofs covered with this typical normal tile occur. In Messenia the wide tegula is used as an imbrex, as in China. On the old cathedral at Athens, a Byzantine structure dating back to the early part of the thirteenth century, a large curved

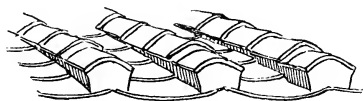


FIG. 36.

tegula with narrow imbrex is found (fig. 36); all the courses are thickly plastered and bear

the marks of great age, and at the eaves the imbrex is supported some distance from the tegula by a mass of stucco. The dome is also covered with the same kind of tiling, the tegulae being cut tapering as they approach the apex of the dome, the imbrices standing out as prominent longitudinal ribs from the apex of the dome to its base. There is also another Byzantine church in Athens roofed with the same kind of tile.

In the modern houses at Athens and in other places the tiles are more flattened than is usual with this form, and at the eaves the upper and lower elements are separated by a considerable space and filled with white stucco. This presents the appearance of an imbricated edge along the eaves. With the exception of certain examples in Spain this is the only attempt, so far as I have been able to ascertain, at the ornamentation of the eaves tiles seen west

of China. In some places in Greece, as at Eleusis, for example, the tiled roof shows broad bands of white painted tiles at the ridge, hip and eaves, with an intermediate band in the middle of the roof; other bands cross these at right angles to the ridge. In the photographs rectangular areas of dark tiles show between these white bands. A treatment of the roof presenting a similar appearance is often seen in Japan and Siam, in these cases white plaster being used. At many places, as at Delphi, Dimitzana and Catania it is customary to place upon the tiles angular fragments of stone; these are placed parallel to the ridge, hips and eaves. Occasionally the same treatment may be seen in Constantinople and Stamboul.

In none of the various forms of normal tile seen in Greece to-day is there an eaves tegula with turned margin, or an eaves imbrex, closed by a circular disc. In all other respects, however, the normal tile approaches nearer the Asiatic tile, as seen in China, Cochín China, Korea and Japan than does that of any other country west of these regions unless we except the rough example from Poona, India, where the tegula is wide.

ANCIENT GREECE.

A general idea of the roofing-tiles of ancient Greece may be gleaned from the article "Tiles" in the *Encyclopædia Britannica*. Under this title the terra-cotta and massive marble tiles used on monumental buildings are briefly described and figured.

In a memoir entitled *Terrakotten am Geison*, etc., by Dörpfeld, Graeber, Borrmann and Siebold, a minute description is given of the terra-cotta roofing-tiles, ridge and terminal ridge-tiles, antifixæ, etc., of certain ancient Grecian temples. Of particular interest is the description of the roofing-tiles found on the site of the Temple of Hera at Olympia. This temple is one of the earliest ex-

amples of Greek architecture dating back, at least, eight or nine centuries before the Christian era. It will be noticed that this earliest known roofing-tile which Graeber designates as the normal tile, has a wide curved tegula, and a narrow semi-cylindrical imbrex (fig. 5) being identical with the Oriental one (compare fig. 11). The size of the tegula was 1.50 metres in length by .50 centimetres in breadth. Graeber says that this tile, common in the Middle Ages, is still much used to-day; it is particularly associated with convent roofs. I have before remarked that this normal tile of Graeber's differs from the normal tile in that region to-day in having a wide tegula and narrow imbrex. The nearest approach to this in the Middle Ages is the one seen on the old cathedral at Athens.

Graeber states that these early roofing-tiles of the Temple of Hera were covered with a black glaze; he also says that glazed tiles have been determined from Argos and Mycenæ. The tiles, however, on the Temple of Hera at Argos were not glazed. It is also stated that a few monumental buildings in Sicily, Italy, Peloponnesus and Athens reveal the use of roofing-tiles. Besides this primitive normal tile described by Graeber, there is another form of tile which must be regarded as an outgrowth from the normal tile, inasmuch as a narrow imbrex covers the line of junction between two adjacent tegulae. In the last mentioned form the tegula is rectangular in shape, flat, with lateral edges turned upward as shown in fig. 37. Graeber describes two varieties of these, one found in Greece in which the upturned edge stands at right angles to the flat portion as shown in fig. 38. In the earlier forms of this variety the reflexed edge is low and is accompanied by a semi-cylindrical imbrex. At a very early date, however, the angular imbrex makes its appearance, and from the time marble tiles were adopted from the terra-cotta form, this becomes the definitive shape of the

imbrex. The other variety is peculiar to Sicily: in this the upturned edge preserves a convex surface; this form is also found in lower Italy, but is not exclusive, as other varieties also occur in that region. Fig. 37 represents the Sicilian form.

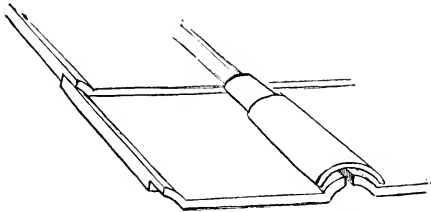


FIG. 37.

In the Boston Museum of Fine Arts, are fragments of tiles from Assos, Asia Minor, dating not farther back than the Roman epoch. The following figure (fig. 38) is a restoration showing the appearance of this tile in position.

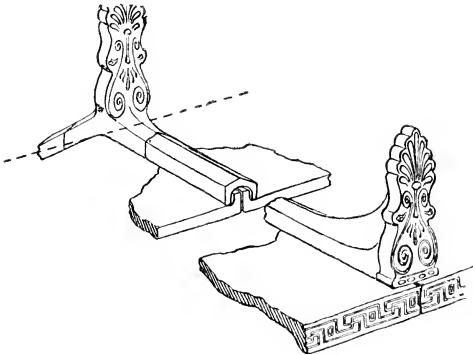


FIG. 38.

It will be seen that the eaves tegula has its margin turned down and bears upon its face an ornamental design in re-

lief. The eaves imbrex has its end closed, not by a circular disc, but by a broad ornamental piece standing erect with anthemion decoration in relief. These designs vary greatly in different fragments, but are all of the same general nature. The roof imbrex continues the same width over the ridge spanning it like a saddle, and has a similar process projecting upward at the crest with decoration in relief on both sides. A ridge-tile of the form of a plain imbrex probably covered the junction of the tegulæ at the crest. This treatment of the ridge-tile has no parallel in the Orient so far as I know. In another form the ridge-tile is semi-cylindrical bearing a leaf-like crest decorated in polychrome; on the lower edge a portion is cut out to admit the ends of the semi-cylindrical imbrices as they approach the crest (fig. 39). This figure is copied from

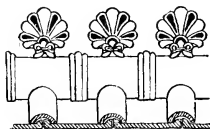


FIG. 39.

Boetticher's work on Olympia (p. 207) and represents a tile from the treasury of the Geloans (Sicilians) at Olympia. In the minute investigation of this subject made by Graeber, he often alludes to the great variety in the minor details of the roofing-tiles seen on these ancient sites. Referring to Olympia, he says: "still more striking than the diversity of the clay material is the multiformity of the kinds of construction presented by the antique roof in Olympia. The terra-cotta roofs there offer such a wealth of forms that one has well-nigh to doubt that all of them sprang from a handicraft native to Olympia, or to the district of Elis, and to believe rather that they repre-

sent an aggregation similar to that in a museum of all the constructions customary in Greece, Lower Italy and Sicily, and this supposition has verified itself, for further studies showed that at the places in Greece and Italy, which we visited, certain particular kinds of construction are used almost exclusively, and that the variety and multiplicity of forms found at Olympia occurred nowhere else to the same extent."

Speaking of the marble roof, Graeber says: "The general system and scheme of the antique marble roof is well known through many publications. This system, however, has not been invented for the marble roof, but had its prototype in the clay-tile roof. The antique roof had to pass through centuries of evolution till it attained that perfection which we admire in the Parthenon of Athens, and the Zeus Temple of Olympia and many other edifices. As regards elegance, one may even say subtility of perfection, the Greek tile roof ranks even above the marble roof."

I cannot forbear quoting further from this valuable memoir of Graeber's. He says in regard to the attachment of tiles on the roof: "A securing of the tiles on the rafters by means of nails did not take place; only the lowest tile, next to the gutter, was always secured by iron or bronze nails to the rafter. All tiles with nail-holes, therefore, belong, without exception, to the gutter, and just so little did the tiles have projections for hanging them to the laths as it is assumed erroneously of the marble roofs, but they rested directly on the rafters, and maintained themselves in their position in part by their weight, in part by supporting themselves through the next lower tile by means of the cutting on their lower surface. This may have occasioned, under certain circumstances, a heavy strain; for instance, a sliding down, involving even the lowest gutter or moulding tiles." And he refers to the

condition of things at the Zeus Temple at Olympia as due to the sliding down of the tiles in this manner.

Graeber presents a restoration of the edge of the roof of Temple C. Selinus, Sicily (fig. 40). Here the elevated process or *antifixa* of the eaves *imbrex* is now detached, and forms a separate piece, which is nailed to the stone coping, and the turned margin of the eaves *tegula* is also separate, and is nailed to the face of the coping-stone. These various elements were moulded in relief and beautifully decorated in polychrome. This temple is supposed to date from 600 B. C.

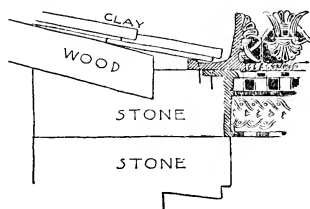


FIG. 40.

Reference has been made to the marble tiles following the form of the later terra-cotta tiles. It has also been shown that the pan tile of Europe has been derived from the normal tile by combining in one piece the upper and lower elements. It is interesting to observe that in the marble tiles of ancient Greece the same combination is shown in some, where the *imbrex* and flat *tegula* with up-turned edge are combined, and, curiously enough, the lap is to the right, as followed by the pan tile of Europe.

ITALY.

Throughout Italy, the usual covering for house roofs is the normal tile (*imb.*). The tiles vary somewhat in size. In Pavia and Ravenna the tiles are quite large, and in

section somewhat angular. In Verona, the tiles appear quite long. Photographs of Parma, Milan, Pavia, Bologna and other cities reveal minor peculiarities in the manner of tiling. In some cases courses of imbrices are close together, and the tiles are often crowded in the courses from eaves to ridge. There is no alignment of the tiles, as in Chinese, Korean and Japanese tiling, and the work always seems slovenly done.

In Verona, fragments of tiles are inserted in the inter-spaces between the ridge-tiles and their junction with the roof-tiles, as shown in fig. 41. At Certosa and Milan rows of imbrices with their concave faces up-

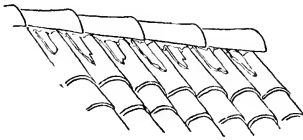


FIG. 41.

permost are placed between the rows of imbrices in their normal position. In other words, after the roof is tiled in the ordinary way, an additional layer is put on in an inverted position between the rows of imbrices. The roofs are low pitched and this extra layer probably offers an additional security.

Beside the normal tile there is often seen a broad flat tile, with lateral edges turned up accompanied by a semi-cylindrical imbrex. This tile is used in Rome, Florence, Sienna, Pisa, Ravenna and doubtless in other cities of Italy. An examination of a large series of photographs shows it to be more common in central Italy. On the roof slopes the broad tegula may be seen in certain courses used as an imbrex (fig. 42).

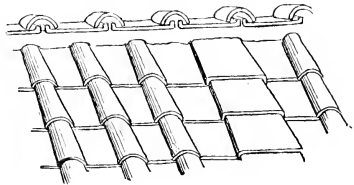


FIG. 42.

This broad tile bedded in stucco is also used as a ridge-tile as shown in the last figure (fig. 42). This tile is a direct survival of the ancient Roman tile which in turn has been derived from the Greeks, unless both Greeks and Romans were indebted to the Etruscans for it. The modern tile is much smaller and thinner. It is often represented in the pictures of old Italian masters (fig. 43). (From a painting by Botticelli in Dresden gallery.)

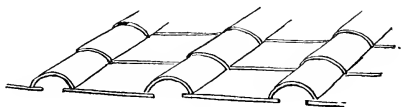


FIG. 43.

A modern tile, probably interlocking, quite small in size, but made somewhat after the style of the tile last described, is occasionally seen. The tegula tapers much more abruptly and is used as an imbrex.

ANCIENT ITALY.

The ancient Roman tile consists of a large flat rectangular tegula with lateral edges turned up, and a narrow semi-cylindrical or angular imbrex, both tegula and imbrex being heavy and massive.

At the Antiquarian Museum at Zurich are a number of ancient Roman tiles; these have the lateral edges abruptly turned up, the imbrex is angular in section (fig. 44). On the exposed and lower edge of the tegula are a few curved marks as if made by the fingers. As these marks are seen on similar Roman tiles at the Royal Antiquarian Museum at Brussels and elsewhere, it would seem to be a special furnace-mark of the maker, or possibly to indicate the lower end of the tile. On the under surface of each tegula,

inclosed in a rectangular panel is impressed the Roman characters LXXIC. This was the mark of the 21st Legion, showing that the Roman soldiers were accompanied by tile-makers, as well as by those pursuing other trades. At the museum last named are some ancient Roman tiles resembling those mentioned by Graeber in the memoir previously alluded to. In these tiles the turned edges differ slightly from those figured by Graeber; the

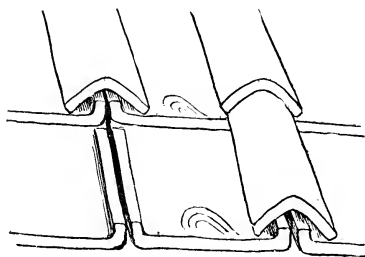
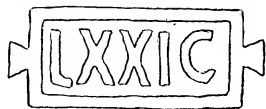


FIG. 44.

lower corners were recessed, however, to fit on the tile below, and the turned edge ceased within a short distance of the top of the tile (fig. 45). There were no perforations for pegs or nails to hold the tile to the roof as is described in similar tiles figured by other authorities.

In the ancient cemetery of Marzabotto, near Bologna, the contents of which have been figured and described with great fidelity by Count Gozzadini, a number of terra-cotta

roofing-tiles were found. These were made after the flat Roman pattern, but were remarkable not only for their massive size, but for certain structural peculiarities, not seen in the typical Roman form. The tegula measured 1.07 metres in length by .80 centimetres in width (fig. 46A). In some examples the upper inferior margin was turned at right angles, and this was strengthened by a thin brace as shown in the fragment (fig. 46D). On the superior surface of the tegula a rounded knob was present (fig. 46E). This was perforated for the admission of a bronze nail having a thin concavo-convex head (fig. 46F), which conformed to the shallow and lenticular knob on the

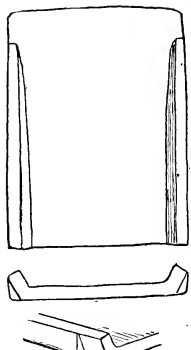


FIG. 45.

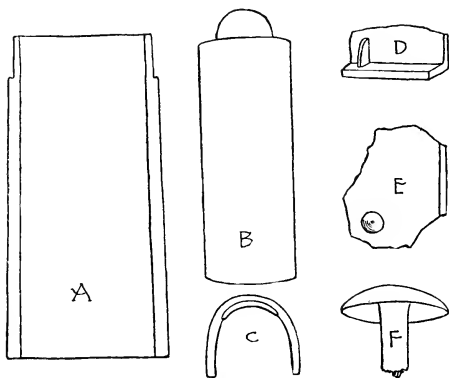


FIG. 46.

tile; by this device the rain was more thoroughly excluded. The imbrices varied in length, the longest being .82 centimeters in length, with a width of .28 centimeters and a

height of .26 centimeters (fig. 46BC.) (The drawings as published do not show these proportions). Many of these fragments show traces of polychrome decoration on their exposed surfaces.

Concerning the age of the Marzabotto cemetery, George Dennis in his *Cities and Cemeteries of Etruria* (Vol. II, p. 543), says "we may safely refer the antiquities found at Marzabotto to the latest days of Etruscan independence, north of the Appenines, which came to an end on the invasion of the Boian Gauls, at the beginning of the fourth century B. C."

SICILY.

The normal tile (*imb.*) is the common form throughout the island. In one old building at Palermo, the tiles are crowded together, from the ridge to the eaves. At Taormina the eaves tiles are pointed with plaster.

SPAIN.

In this country the roofing-tiles everywhere seen belong to the normal tile (*imb.*). These are usually semicircular in section and much larger than the forms farther east. At Burgos the tiles are crowded on the roof, at the eaves the ends of the tiles are pointed with plaster. At Granada a similar treatment of the eaves tiles is seen. In one portion of the Alhambra, light and dark tiles are arranged on the roof in such a way that a clearly marked zigzag pattern is carried out. In another and older portion of the Alhambra, the tiles, instead of being roundly curved in section, are somewhat angular. At the eaves, the imbrices are doubled and, between the upper and lower imbrex, separated by the space equal to the width of a tile; a mass of white stucco or plaster is interposed. As there appears no break in the alignment of the tiles from the eaves to the roof, the lower course of eaves tiles probably rests horizon-

tally on a projecting cornice, the plaster diminishing in thickness backward for a few courses as shown in fig. 47. An evidence that this is so is shown in an end view of another portion of the building, where a cornice or shelf, projecting below the eaves, has settled by the weight of plaster and tiles above.

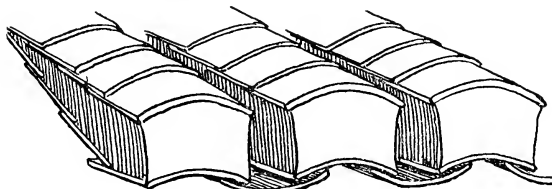


FIG. 47.

At Seville, Alcazar and other places, the courses of tiles are slightly separated at the eaves and the spaces enclosed by the tiles are filled with white stucco, as shown in fig. 48.

In a picture of the Church of S. Maria de L'Antigua at Valladolid, Spain, published in the *American Architect* for December 10, 1887, the typical Spanish tile is shown.



FIG. 48.

The tower of this church seems to be covered with a pointed flat tile.

MEDITERRANEAN BORDERS.

A rapid examination of a collection of photographs of places bordering the Mediterranean, from the Isle of Rhodes to Tangiers, shows the universal use of the normal tile (*imb.*). A picture of the mosque of Tangiers shows a wall, or a house with unperforated wall, having a very steep

pitched-roof covered with somewhat smaller tiles than those cited from Spain. The ridge is covered with the ordinary ridge-tile elevated to a considerable distance above the roof, the interspace apparently filled with white stucco or plaster, giving it an appearance in the photograph, of a high and narrow vertical ridge. The tiles are very unevenly laid, and it will be noticed that in the photographs of Spain, Italy and other countries bordering the Mediterranean, the tiling seems always to have been done in a slovenly manner. This appearance is probably due, in many cases, to the buildings being old and the tiles having being thrown out of alignment by the wind and other agencies. The thorough and accurate way in which the Asiatic roofs are tiled stands out in marked contrast to the loose manner of tiling of western nations using the normal tile.

MEXICO.

I am indebted to Mr. Sylvester Baxter and Mr. Denman W. Ross for photographs and descriptions of the roofing-tiles of this country. Mr. Baxter observed on some roofs a large flat tile either plain or corrugated, the corrugations being quite near together. These were usually coated with a golden-green glaze. Around the City of Mexico and in the high table-lands the flat tile was used. Photographs of buildings at Orizaba, taken by Mr. Ross, show a large tile identical with the Spanish form. Mr. Baxter observed that in some cases the lower tile was painted white on the upper surface, white lead being apparently used, and presumably to make the roof water-tight. He also observed at Cuantla, Morelos, in the tierra caliente, a large flat tile with upturned edges and semi-cylindrical imbrex. A similar form to this has already been described from Central Italy, and, as before remarked, is a survival of the ancient Roman tile. The modern form is much thinner. The tiles bordering the eaves differ in no re-

spect from the others, though the under course of tiles may be laid double.

Chili, Peru and other South American countries have the normal tile (*imb.*) and this runs up on the west coast to California.

BELGIUM AND HOLLAND.

The pan tile is the dominant form in these two countries. That it was also the common form a few hundred years ago is shown in pictures of the old Dutch masters.

In Holland, one may often see roofs thatched half-way down and tiled the rest of the way to the eaves. In the better class of houses in the country the entire roof is tiled. At Utrecht, large, slightly-bent tiles are used for ridge and hip. The pan tile is often made with a square opening in it in which glass is fitted. The tiles are often glazed either red, gray or blue. In Belgium, they appear either black or bright red. On very old churches the normal tile (*imb.*) is seen.

It is interesting to observe that in those portions of Germany, bordering on Holland and Belgium, the German flat tile is supplanted in a measure.

The pan tile, *pannen tegchel*, as it is called in Holland, evidently originated in Holland or Belgium. In England it retains the Dutch name *pannen*, anglicized to pan. It is also called the Fleming tile. In Poland, it is called the Holland tile.

NORWAY, SWEDEN AND DENMARK.

The pan tile is in universal use in these countries. In Norway, away from the larger cities, wooden shingles painted red form the ordinary roof covering. The pan tile is often a bright brick-red in color, or glazed a dark brown. The red-painted wooden roofs would seem to be an imitation of the red tiled roof. In Christiania, an old

house with the date 1662 was covered with pan tiles. In Bergen, the pan tile is commonly seen.

Mr. Ipsen informs me that in Copenhagen the normal tile (*imb.*) is sometimes found on old churches, and is commonly known by the name of monk tile; this name indicating that in Denmark, as in Germany, this form of tile was introduced by the monks from the South.

JAVA.

At Buitenzorg and other towns in the interior of Java a pan tile is seen. The tile is well made, very light and

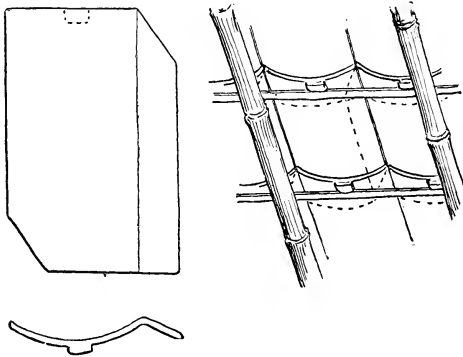


FIG. 49.

thin, and having a length and breadth respectively of 28 centimetres by 18 centimetres. The covering edge is flat, and not curving, as is usual. The upper edge of the tile has a nib which holds it to the battens fixed to bamboo rafters (fig. 49).

I do not recall seeing an eaves tile with turned margins.

There are many Chinese in Java, and their buildings present the type of the Southern Chinese. On these buildings the normal tile (*imb.*) probably occurs, but I made

no note of this matter during my visit there. The pan tile has probably been introduced by the Dutch, or possibly by the English before the Dutch. Fig. 50 is reproduced from a photograph showing the appearance of



FIG. 50.

Java houses after a shock of earthquake. In this is shown the light structure of the roof supporting the tiles.

GERMANY.

Throughout Germany the flat tile is the common form. When the lower border of this tile is slightly rounded it

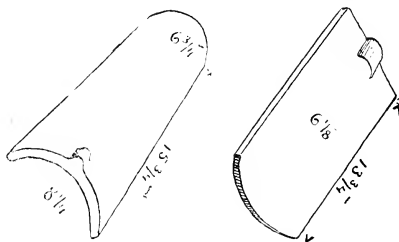


FIG. 51.

is called, in certain portions of the country, "beaver-tail" (fig. 51A). In Berlin the lower border of the tile is

usually rounded (fig. 52), in Weimar it is square at the end, in Nuremberg it is pointed (fig. 53). Occasionally the tiles are laid in a double layer as shown in fig. 54.

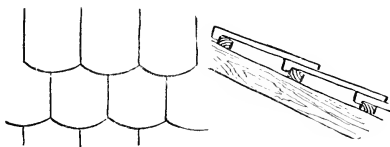


FIG. 52.

The flat tile not only extends throughout Germany but runs south to Switzerland, west through France, at least through the central and northern portions, and southeast through Austria to Hungary and Poland, and, probably, northeast to Russia. As one approaches Belgium and Holland, the home of the pan tile, this tile frequently takes the place of the flat tile, as seen at Dusseldorf, Bonn, Cologne, Bremen and Hamburg. This tile is commonly red or glazed black. The pan tile is also occasionally seen farther south. At Freiburg it is known by the name of "Jumping hound," from its fancied resemblance, at the eaves, to the movements of jumping hounds. In the country around Bremen and Hamburg the roofs are often

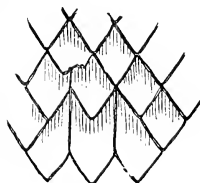


FIG. 53.

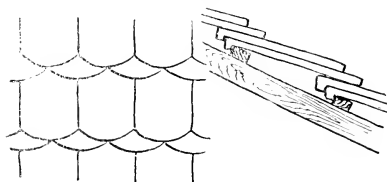


FIG. 54.

thatched, but in these cases a square area about the chimney — which looks odd thrust up through a thatched roof — is covered with pan tiles. In many of these pan-tiled

roofs the eaves, ridge and ends of the roof are often finished with a few courses of slate, as shown in fig. 55. In Bremen a heavy ridge-tile of the ordinary form is used (fig. 56).

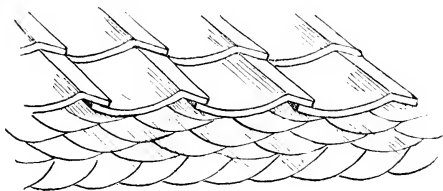


FIG. 55.

In very old buildings throughout Germany, usually on old churches and convents, the normal tile (*imb.*) is often seen. Professor Virchow informed me that this tile was introduced into Germany by monks, from the Rhine, in the twelfth century. As before remarked, this tile is known as the monk tile in Copenhagen.

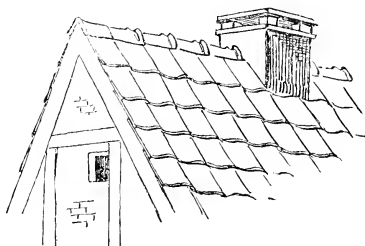


FIG. 56.

The appearance of a flat tiled roof, as seen from within is shown in fig. 57, sketched in the attic of an old house in Nuremberg. Here the manner of propping up a tile with a stick, for the purpose of letting in light is shown; this is done for light and not for ventilation, as the roof is

sufficiently ventilated by the loose adjustment of the tiles. Other means for admitting light to the attic are shown in

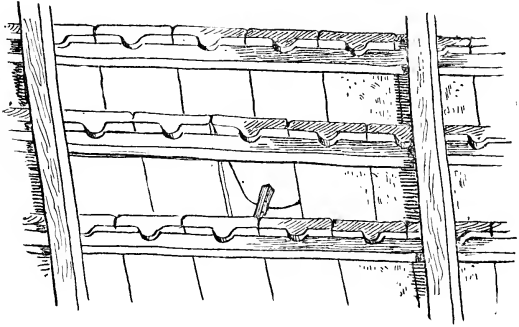


FIG. 57.

fig. 58 (Freiburg) and 59 (Weimar). These hoods or dormer windows are made out of a single piece of terra-

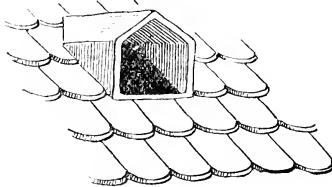


FIG. 58.

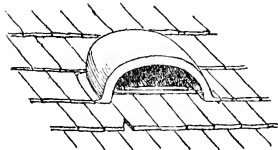


FIG. 59.

cotta ; they are secured to the roof by a broad flange around which the tiles are fitted.

Fig. 60 shows the manner of finishing the end of a roof; the battens upon which the tiles are hung project through the wall and the tiles are cut longitudinally to continue the alternate adjustment of tiles to the edge.

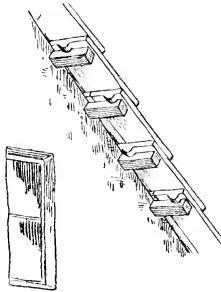


FIG. 60.

At Nuremberg the flat tile is everywhere seen. Fig. 61 is reduced from a photograph of Nuremberg houses showing how deftly the tile is handled in covering dormer windows and various projections.

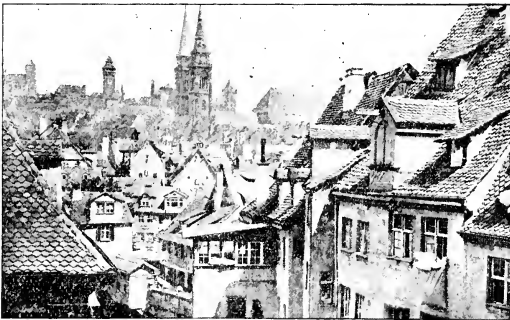


FIG. 61.

windows and various projections. In some cases the lower border of the tile is rounded, in others pointed. Other

forms of tile are seen in this picturesque old city. On the old Roman tower of the castle may be seen a large, thick, coarsely made semi-cylindrical tile, being much larger at the upper end, measuring .51 centimetres in length, and a width at its widest end of .15 centimetres. This tile has a thick nib to hold it to the battens. The

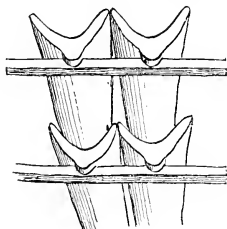


FIG. 62.

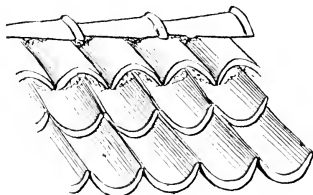


FIG. 63.

spaces between the tiles were thickly plastered though greatly out of repair, as gleams of light were coming through various chinks. Fig. 62 shows the appearance of this tile from within the roof, while the appearance from without is shown in fig. 63. This sketch is taken from the castle wall tower which is supposed to be nearly 400

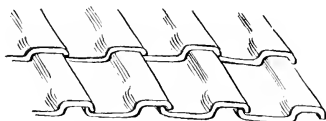


FIG. 64.

years old. The ridge is seen covered with ordinary semi-cylindrical tiles, while a single course of tiles next to the ridge shows the roof-tile used in the form of an imbrex. All the interstices were thickly plastered. The tile was accounted the oldest form used in Nuremberg, and may be regarded as the normal tile. A recent form of tile, which may be looked upon as an extreme modification of

a pan tile, is seen on certain portions of the city wall (fig. 64). At Urfurt (fig. 65) and Wurtzburg (fig. 66) a tile is often seen with a slight ridge turned up on one side, and a recurved edge on the opposite side which laps over the slight ridge on the next tile. This form is certainly a modification of the pan tile, and curiously enough laps



FIG. 65.



FIG. 66.

to the left, as in the case of the Japanese pan tile. At Hildesheim old houses are covered with a similar form of tile lapping to the left.

POLAND.

I am indebted to Mr. J. Adamowski for information concerning the roofing-tiles of Poland. An architect friend of his, Mr. Kozłowski, of Czenstochowa, writes that the most common form of tile in Poland is the flat tile with rounded end, differing in no respect from the ordinary German tile, and usually laid in a double row, as shown in fig. 54. The dimensions, in English inches, are 7 by 14.

The pan tile lapping to the right is also seen in old buildings and churches. It is no longer made in Poland. This tile is known by the name of Holland tile, and its introduction to Poland may have been by way of the Baltic.

RUSSIA.

An examination of photographs and numerous inquiries show that the tiled roof is not common, but, when seen, it is composed of the flat tile. Dr. Berlin, a Russian physician, and her brother, stated to me that formerly an

angular tile, in form like the ridge-tile, was used as a roofing-tile. These tiles were placed in rows running from the ridge to the eaves, with the crest uppermost, no under tiles being used. The tiles were simply bedded in cows' manure. Repeated questioning failed to modify this statement. It is recorded that in other regions in the east it is customary to plaster the house with manure.

Photographs from the Caucasus show the normal tile (*imb.*) in use.

SWITZERLAND.

The flat tile is everywhere common in Berne, Zurich and other parts of northern Switzerland. In very old houses the normal tile (*imb.*) is occasionally seen (fig. 67),

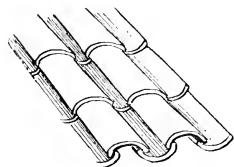


FIG. 67.

but even in these cases the newer additions to the roof are covered with a flat tile. In some instances the ridge is finished with wood or metal, instead of the usual ridge-tile. The tiles are often seen aligned instead of breaking joint; in this case the roof is first shingled. An elaborate structure of brick, stone and roofing-tile, held together by mortar, forms the top of most of the chimneys, and suggests the idea of a bird-house, or such an affair as a child might build with blocks.

They are certainly picturesque and apparently durable, as none of them seem to be dilapidated. Fig. 68 is reproduced from a rough sketch of a few chimney tops in Berne.

At the Historical Museum at Berne, I found an interesting collection of roofing-tiles. I learned that the curator of this department was an architect, and this accounted for the extent of the collection, which was the best one that I saw anywhere in Europe. Among the tiles was one

from the Castle of Trachselwald with the date of 1300 on the label. This was a flat tile with pointed end. It was 34.2 centimetres long and 19 centimetres wide. A rude

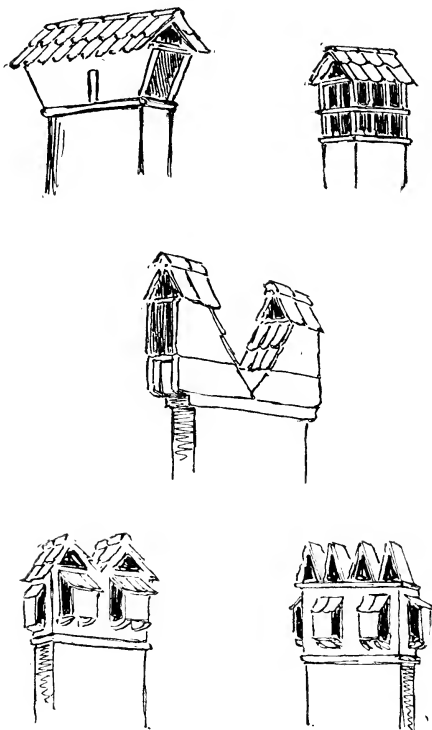


FIG. 68.

figure of a bear with rough bars below and above, enclosed in a circular panel, was impressed upon the tile near its

lower end (fig. 69). Another flat tile, also pointed at the lower end, had two many-rayed stars impressed upon it. The date 1666 had been incised with a small point across the middle of the tile, and at the square end the same date had been marked with the finger (fig. 70). This tile was

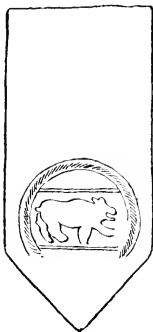


FIG. 69.

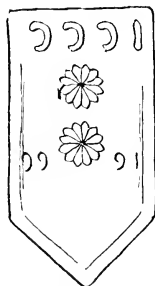


FIG. 70.

36.8 centimetres long and 19.3 centimetres wide. In this collection was a curious glazed tile, evidently made for the top of a stove, but representing a sloping roof. This had alternate squares of brown and straw-colored glaze, representing the pointed flat tile. Its date was supposed to be



FIG. 71.

1300. In the collection were also ridge-tiles with foliated ornament (fig. 71). These were green glazed, and labelled Castle Thurgau, Canton of Thurgau, city of Arbou. The specimen figured was 37 centimetres in length.

At the Antiquarian Museum at Zurich were preserved a few old flat tiles (fig. 72). These far exceeded the dimensions of the other flat tiles described, one specimen measuring 46.8 centimetres in length and 17.2 centimetres in breadth. The nib was large and broad, and the lower end of the tile was roundly pointed. Another specimen of the same length, and having a breadth of 23.5 centimetres, was pointed, the pointed end being cut off square.

The lower exposed portion was coated with salt glaze; the nib was small and recurved. These tiles were about 350 years old.

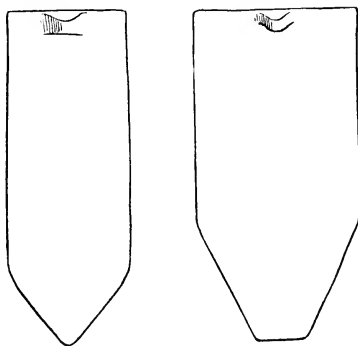


FIG. 72.

At Basle the buildings were somewhat mongrel in their appearance, partially losing their Swiss character without assuming their German character. The tiles were flat with rounded ends. On the old cathedral in this town the tiles were glazed green, red and white and in the rebuilding of certain portions of the cathedral new flat tiles, glazed the same colors, were being used, the bright glaze of even the old tiles forming a startling and disagreeable contrast to the time-stained stone and other material of the structure. Some interesting ridge-tiles with green and brown glazes

were found in a local museum. These had Gothic scrolls and leaves springing from their crests; in one case the finial was held to the tile by an iron rod, as a dowel. (The height of this tile was .67 centimetres.) These

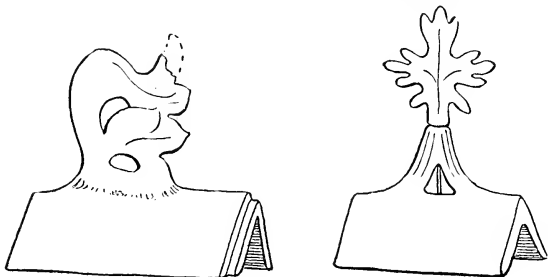


FIG. 73.

tiles were labelled Nicholas Chapel, fifteenth century (fig. 73). At Interlachen, the flat tile was seen on some of the older buildings, the modern structure being roofed with modern forms of tiles, which seemed to have certain merits in securing a tight roof (figs. 74 and 75).¹

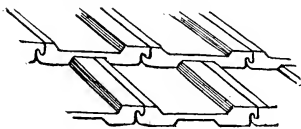


FIG. 74.

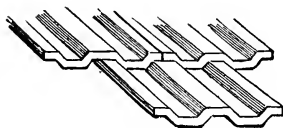


FIG. 75.

¹ A modern interlocking tile is made at Allkirch village, Canton of Berne, by Gilardoni Brothers. I found it on many houses at Berne, and, if I remember rightly, it was the tile used on the new arsenal at Berne.

The new arsenal at Berne had a tiled roof resting on battens, each tile so loose that it could be easily pushed up from within. There was no sheathing beneath, and here and there glints of light could be seen. Indeed, it was blowing a gale and snowing at the time I was there, and a little snow had blown in. That the roof was waterproof was implied by the fact that a new building filled with polished weapons had only this kind of a roof-covering for protection. From the behavior of certain tiled roofs in our country, we have certainly not yet learned the secret of a good tile.

FRANCE.

My information concerning French roofing-tiles is very meagre, being chiefly based on hasty notes made in Paris and vicinity, and observations from the main railways from Paris to Brussels and Calais respectively, supplemented by the examination of a few photographs.

The flat tile appears to be the dominant form throughout central and northern France, while the normal tile (*imb.*) is common farther south, and especially along the Mediterranean. The flat tile is usually square at its lower end and smaller than the German or Swiss form. At the Paris Exposition many forms of roofing-tiles were exhibited from French tileries, among which were large numbers of flat tiles.

The introduction of roofing-tiles among the peasantry must have been comparatively recent. Leslie (*Essays on Moral and Political Philosophy*), writing of Puy-de-Dôme, a central department of France, says: "I saw many instances of a change which is the precursor of an elevation of the standard of habitation, namely, the substitution of tile for thatch roof." In Spenser's *Sociological Tables* a number of references are conveniently accessible concern-

ing the roofing material in France in early centuries. Vitruvius, the famous Roman architect, in the first century of our era says: "The Gauls to this day build their houses of boughs, reeds and mud, with roofing of oaken shingles or of straw. Even at Massalia we may observe roofs made without tiles, of earth kneaded, as it were, with straw." "It appears from Orderic's narrative (1090 A. D.) that the roof of the castle was covered with shingles of wood instead of slates or tiles. This is still the case with respect to many of the towers of the country churches in the Lieuvin and the Roumois."

"The working of plaster quarries, the use of tiles for roofing houses and afterwards the discovery of slate . . . entirely changed the appearance of houses. It was only in the fifteenth century that slate was used. In 1465 it was just begun to be known of." (Chérol, *Dictionary of Institutions, Manners and Customs of France.*)

GREAT BRITAIN.

In England two kinds of roofing-tiles are in use: the flat tile, which is the form most commonly seen, and the pan tile, which is found widely distributed. This tile is also known as the Flemish tile, this name implying that it was first introduced from Flanders.

The cheapness and excellent quality of slate and its almost universal use have evidently checked the development of the roofing-tile. One sees no attempt at architectural effect in the treatment of the roof, but the tiling is done in that durable manner which characterizes English work in general. The head of the pan tile has two nibs instead of the usual single one, and the tiles are adjusted with greater care to the roof.

In the collection of building material at the South Kensington Museum may be seen a great variety of roofing-

tiles. In the catalogue of this material, published by this museum in 1876, these roofing-tiles are variously recorded as plain tiles, red, green and brown; plain tiles colored to match old tiling; terra metallic; single, double and treble channelled tiles; flat or Roman ornamental roofing-tiles; ridge-tiles with ornamental crests, and many others. As most of these tiles are modern productions (many of them the result of England's awakening which followed the World's Fair of 1851, and the renewed impulse of the French Exposition of 1855), their consideration does not properly come within the scope of this paper. One tile, however, figured in the catalogue above referred to, appears interesting as well as serviceable (fig. 76). It is a French

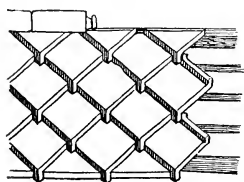


FIG. 76.

tile known as the tile Courtois, from the name of its inventor. It seems to have the merit of simplicity and but little of the tile is concealed in the lap. In 1856-57, this tile was made at Stamford, England, and used on a number of buildings. In 1876,

a tile somewhat similar to this was made near Hull. Many of the tiles mentioned in the catalogue failed to come into general use. An example of the treble channelled tile I saw at Cambridge, England, and, curiously enough, at Stockholm. This tile might be regarded as a variety of the pan tile with three equidistant folds, the side lap being made as in the pan tile.

From various sources one may gather a continuous history of the introduction and successive appearances of the various forms of roofing-tiles in England. The early British houses were circular, with low stone walls and conical shingle roofs. With such a form of roof the use of terra-cotta roofing-tiles was well nigh impossible, and a square

house with the ordinary sloping roof must have preceded the use of roofing-tiles.

Before the introduction of pottery tiles, rough stones were used for roof coverings. "In localities which supplied laminated stones such as Gloucestershire and Hampshire in Britain, the Romans often roofed their buildings with stone tiles fastened on with iron nails" (see tiles, *Encyclopædia Britannica*). Lieutenant-general Pitt-Rivers in a communication on an ancient British settlement excavated near Rushmore, Salisbury (*Journal Anthropological Institute*, Vol. xvii, p. 190), records that "tiles of Purbeck shale, with nail-holes to fasten them by, were also found more frequently in the rich quarter than elsewhere and terra-cotta tegulæ were also found there, but only in fragments and used as pavements, for which purpose these tiles were frequently employed elsewhere. The absence of imbrices which are a necessary adjunct in the formation of a Roman tiled roof confirms the opinion that the roofs of the Romano-British village were not tiled in this way. Although the fragments of the tiles show that they had certainly been originally constructed for roofing, their use for a second-hand purpose conveys the impression of poverty, although too much stress must not be laid upon the circumstances."

It would be interesting to ascertain whether any fragments of these tegulæ had traces of cement upon them, for we have seen that in Japan, the tegulæ well bedded in clay or pointed with mortar may be used without imbrices.

It was customary in the Middle Ages and up to within recent centuries to use rough-stone tiling. At Broadway, near Worcester, England, one may see a village in which many of the cottage roofs are tiled with small flat stones of the roughest description. These are held to the roof by oaken pins which suspend them on the battens placed

across the rafters for the purpose. Fig. 77 shows the appearance of one of these cottage roofs and the manner in which even the small roofs of dormer windows and hips may be neatly covered by this rough material.

Fig. 78 shows the appearance of a portion of the roof from within. The stone tile (fig. 79) used for this purpose measures, roughly, .22 centimetres in length by .14 centimetres in breadth, with a general thickness of .02 centimetres. It is made of some fossiliferous limestone. I learned that these houses were over three hundred years

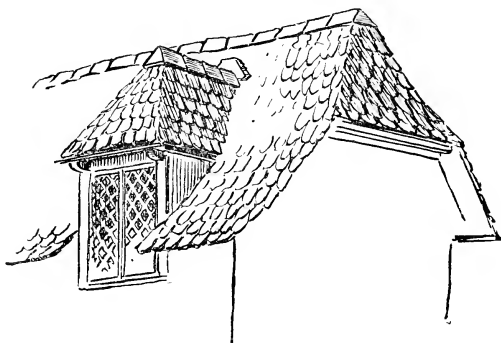


FIG. 77.

old. I also observed on one of the oldest houses in Oxford similar rough-stone tiles, and doubtless, they occur in many other places.

Mr. Ross Turner informs me that in Bermuda a rough, flat tile is cut from the coral sandstone rock, and cedar pins are used to hold the tiles to the roof after the manner of the rough, stone tile just described. An old house at St. Georges, over two-hundred years old, and St. Peter's Church, St. Georges (1630-40) were covered with this tile and they are in use to-day.

In an interesting work by Thomas Wright on the *Homes of Other Days*, many reproductions of old drawings of Saxon and Norman times are given, from which some hints of the kinds of roofing tiles in use may be found. From the Harleian MS. dating from the ninth century, a picture is given of an Anglo-Saxon house; in this picture a variety of roofing-tiles are shown, the most conspicuous of which is the normal tile. The flat Roman tile is also given, and another form resembling round-ended flat tiles, though these may be wooden shingles. Flat Roman tiles again

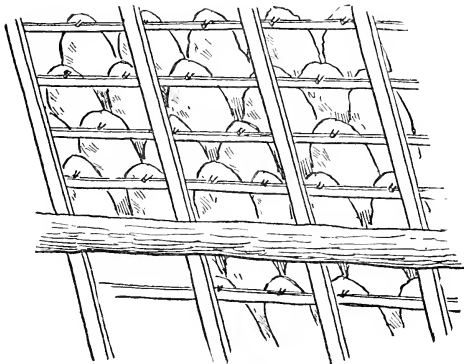


FIG. 78.

appear in another drawing of the tenth century, and in another picture of this epoch the flat tile, with round end, and the normal tile are represented. A picture of a town of the tenth century shows only the normal tile. In an Anglo-Saxon MS. of the Psalms, the normal tile is indicated, and what appears to be an imbricated ridge of tiles. In a roof shown in the Bayeux tapestry, the normal tile is seen. In an early Saxon illumination, a large normal tile is shown. In early Norman times, the normal tile is de-

picted in the drawings. In all the above cases the normal tile (*imb.*) is the one indicated. A complete view of a house is shown in a MS. of the fourteenth century, and this represents the flat tile rounded at its lower end. In the same MS. flat tiles are shown arranged in a form often seen in the arrangement of slates in England to-day, where an interspace of an inch or more is left between contiguous slates in an horizontal line. From this time on, the flat tile is the only one shown in the various drawings given. It would seem by this that the pan tile was introduced from Belgium within recent centuries.

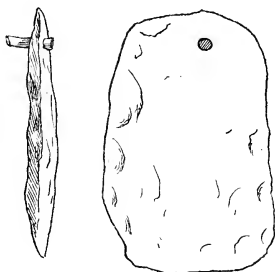


FIG. 79.

In consequence of the frequency of fires it was enacted in the first year of Richard I (1189) that the lower story of all houses in the City of London should be built with stone and the roofs covered with slate or tile (*Pictorial History of England*, Vol. II, p. 230). In the fourteenth century, London houses were generally roofed with tiles.

"In taking down part of a late Norman building in Southwark some years ago, to make the approaches to the present London bridge, some tiles were found built into the wall and may have formed part of the original structure. They were thirteen inches by eight inches and varied in

thickness from five-eighths of an inch to an inch. Half of one side, which would have been exposed upon a roof, was glazed, and they were made with pin-holes in them, as is still the custom in some districts." (*Glossary of Architecture*, Vol. I, p. 463). In the work above cited it is stated that, in the fourteenth century, "the manufacture of tile was one of sufficient importance in England to require regulation by statute . . . whereby the dimensions of plain tile are fixed at ten by six and one-fourth and half an inch and half-quarter thick, at least. Roof or crese tile at thirteen inches long, thickness same as other." Also that, in the Middle Ages, tiles were extensively employed in covering buildings though they seem always to have been considered an inferior material to lead. In the same work are given some remarkable ridge-tiles with figures, crosses, etc., modelled upon them. These were found at Great Malvern and London; the statement is also made that flat tiles only were used at that time.

From the above data, we venture to suggest the following historical sequence in the introduction of the various forms of roofing-tiles into Great Britain: First, the large flat Roman tile and the same time the rude stone tile probably devised by the Romans while in England. Second, the normal tile, probably introduced by monks. Third, the flat tile introduced from Normandy, and, finally, the pan tile introduced from Belgium.

The flat tile is not only used for roofing but is also used in finishing the vertical walls of a gable end. In this case the tiles may be cut pointed, or otherwise shaped, as in fig. 80. Dobson's hand-book of *Tiles and Tile-making* says that pan tiles were formerly made with holes in them for the reception of the tile-pins by which they were hung on the laths. The common method now is to turn down a couple of nibs at the head of the tile, which answers

the same purpose. The roofing-tile is used for other purposes besides that for which it was originally designed. In flower-gardens the flat, round-ended tile is found very serviceable in separating beds or bordering paths, the tiles

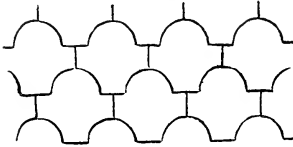


FIG. 80.

being partially buried in the ground vertically, forming a much better dividing line than do strips of board, which soon decay. As a coping for brick walls the roof-shaped ridge-tile

forms a good and picturesque top. The same form of ridge-tile placed in an inverted position may often be seen on the steep slopes of grass-covered railroad embankments, as cheap and useful water-conductors.

UNITED STATES.

We have seen in the course of this paper that in all parts of the world, outside of savage areas and under all climatic conditions, people shelter themselves beneath roofs covered with terra-cotta tiles. With this wide dispersion of roofing-tiles, however, there still remains a territory extending from the Atlantic to the Pacific, embracing Canada and the United States, which is virtually destitute of this ancient form of roof-covering. It is a curious fact that a material so cheap, durable and picturesque, and one so widely distributed throughout the world, should not have effected a lodgment in this country. It seems all the more singular when it is considered that the early colonists—Spanish, Dutch, French, English, German—all came from tile-using countries. This curious condition of things can only be accounted for by the fact that, at the outset, wood was so much cheaper than any kind of baked clay that it was used in the form of clapboards and shingles to

the exclusion of other material, and thus the habit finally became ingrained.

That early attempts were made to use tiles in this country is attested by Mr. F. A. Barber, in his interesting article on the "Rise of the Pottery Industry in the United States" (*Popular Science Monthly*, December, 1891). In this article he shows that the flat roofing-tile was used in Lancaster County, Pennsylvania, as early as 1769, as tiles bearing the date scratched upon them have recently been discovered there. I am indebted to Mr. Barber for the following cut of this tile (fig. 81). As the form of this

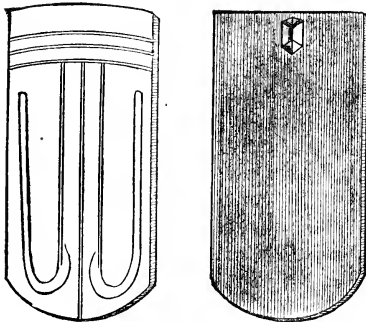


FIG. 81.

tile and its dimensions correspond to the average flat tile seen in Germany, it is almost certain that the tile was introduced by the early German emigrants to that region. I am also indebted to Dr. Charles C. Abbott, of the University of Pennsylvania, for information regarding some pan tiles discovered by him on Burlington Island, Delaware River, New Jersey. These tiles were found associated with rudely made red and yellow brick, on the site of a house built by the Dutch in 1668, and shortly afterwards destroyed by the Indians. The outline of the specimen

sent me by Dr. Abbott shows the typical Dutch pan tile of the roughest description.

Within recent years, pan tiles and flat tiles have been manufactured and used in this country. Their use has been mainly confined to large structures, not for the sake of economy or utility, but for architectural effect. Such roofs have been far more expensive than similar ones in Europe, and judging from the trouble many of these roofs have given, it is quite evident either that the right kind of tile has not been made, or that it has not been properly applied to the roof. From the frequent breaking of the tiles, it has been supposed that our climate, with its rigorous changes, was the cause of this. I have observed, however, in Europe, that tiled roofs are quite as common in regions north of the line of frost and snow as below that line. In England, the effect of frost is spoken of as being unfavorable to tiled roofs. Despite these drawbacks, it would seem that the terra-cotta tile, when properly made and adjusted, is one of the cheapest and most durable of roof-coverings, as it is certainly one of the oldest and most widely distributed.

Acting as a non-conductor, the upper portion of the house is warmer in winter and cooler in summer. Slate roofs absorb and transmit a good deal of heat. Shingle roofs are a menace in times of conflagration. With the best tile clays in the world and an abundance of the rude labor usually employed in tile-making, there is no reason why roofing-tiles should not come into common use in this country, as they have in all other parts of the world.

INTERLOCKING TILE.

At the present day there are a great many forms of tiles made in Europe, especially in France and Switzerland, some of which are very ingenious. The object to be at-

tained in an interlocking tile is to devise a form which shall, by a series of ribs and corresponding depressions, more thoroughly exclude water. In the United States, tiles of this kind are being made besides the ordinary pan and flat tile. It is not within the purposes of this paper to speak of these in detail, as there are many kinds each possessing certain merits.

I cannot forbear, however, alluding to a remarkable exhibition of this material at the late Paris Exhibition which suggested what an extraordinary industry might spring up in this country if the merits of terra-cotta roofing-tiles could be made more widely known. In this exhibition there were not only a great many displays of the ordinary flat tiles, but there were pan tiles as well as interlocking tiles made of pressed glass, by the use of which dark warehouses and attics might be made light. The tiles were made precisely like the terra-cotta ones, so that here and there they could be introduced thus letting in gleams of light in usually dark places, or the entire roof might be covered with these glass tiles. There were also terra-cotta tiles perforated to admit little squares of glass. Graeber has called attention to ancient Greek tiles in the temples at Phigalia, Athens, and other places, in which the large flat terra-cotta tile was perforated for the purpose, as he believes, of admitting light in dark places under the roof.

TILE-MAKING.

In the course of this paper it has been shown that throughout the world with the exception of our country and Canada the use of terra-cotta roofing tiles is universal. There is no reason why they should not come into general use in this country. There are large regions in the United States, like Arizona, New Mexico and certain

western states and territories where forests are scarce or altogether absent, yet having an abundant supply of coal suitable for the baking of tiles, and the best clays in the world. With the rapid destruction of our forests and the consequent increase in the price of wood, shingles and clapboards, the tile-making industry should spring up in many parts of the country.

A few brief notes, concerning the making of tiles, are here appended to call attention to the simple appliances and the rude character of the labor employed in the manufacture, in the hopes of encouraging the industry. If we have brick-kilns everywhere we should be able to sustain tileries also.

Edward Dobson's *Hand-book on Bricks and Tiles* in Weale's series, gives illustrations of the various machines used in the making of flat and pan tiles. From this we learn that in Staffordshire a workman may produce 1,300 to 1,500 flat tiles in a day. In Gwilt's *Encyclopedia of Architecture*, it is stated that "clay from which tiles are made will make good bricks—the converse does not hold good, it requires tough clay to make tiles, on account of the thinness of the tiles. Much care is required in baking; if the fire be too slack, they will not burn sufficiently hard, and if too violent they glaze and suffer in form."

It is observed also that glazed tiles are not so much affected by frost. In Europe, as in Japan, old tiles are considered better than new ones. We learn from the same authority that an ancient custom was to bed tiles in hay or moss. When the roof is full pitch, this suffices without mortar; with less pitch, mortar is used to point the tiles in order to keep out snow or rain in a high wind. We have seen that in Japan and Korea, and probably in China, also, mud or clay is used in which to bed the tile, and in these as well as in all other countries mortar is used in

various ways to point the tiles, particularly at the eaves and ridge.

In Germany, the making of flat tiles, as I saw it near Wurtzburg, was of the simplest description. An iron frame having the outline of the tile to be made was the only important implement involved in the process. This frame represented the mould. The table upon which this rested consisted of a thick piece of plank, over which was spread a piece of woollen cloth, one edge of which was nailed to the lateral edge of the plank, while the opposite edge of the cloth had secured to it an iron rod, the weight of which kept the cloth drawn smoothly over the plank. The iron frame was now placed upon the cloth (fig. 82)

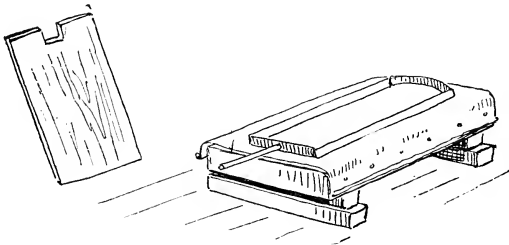


FIG. 82.

and clay was packed into it with the hands, and then pounded down with a wooden mallet such as a moulder might use. A straight-edge was used to scrape away the superfluous clay, a little mass being left at the head of the tile which was afterwards shaped into the nib which was to hold the tiles to the laths or battens. This being done, a square piece of board notched at one end to admit the nib was placed on the frame. The workman then grasped the iron rod attached to the free end of the cloth and, with the other hand holding the board in its place, lifted the cloth and inverted the whole thing, transferring the soft tile to the

board.¹ The iron frame was then removed, and the board with its unbaked tile was placed in the sun to dry. The workman informed me that he could make a thousand tiles a day. Fig. 82 shows the iron frame resting on the flannel in position to be filled with clay. The board upon which the unbaked tile is to be transferred is to be seen to the left. Fig. 83 is reproduced from a hasty sketch of a Wurtzburg tiler at work.

Large dome-shaped brick ovens were used in baking

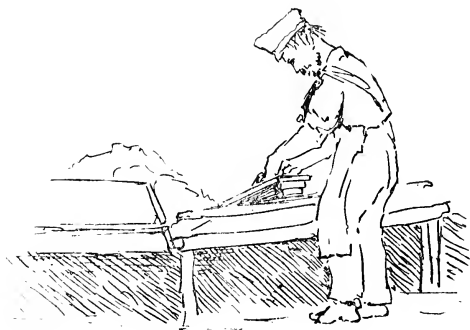


FIG. 83.

the tiles. The structure was flat above, and leading down to the ovens below were small holes two or three feet apart. The fire, having been started, was afterwards fed by pushing into these holes at short intervals small quantities of fine coal or coal-dust. The utilization of coal-dust in this way struck me as an economical method of using this waste product. I was informed that ordinary bricks were baked in the same way.

¹Many old Korean and Japanese roofing-tiles show on their lower side a cloth-mark impression, and doubtless similar methods were resorted to in their manufacture.

Mr. Howard Walker informed me that in France he had seen a tiler at work first shaping a flat piece of clay into the proper dimensions and then bending it over the upper part of his leg, at the same time pushing up a nib of clay at the head of the tile with his thumb.

In Japan the tiles are made in moulds, dried in the sun, and baked with pine fagots and twigs for fuel. Fig. 84 represents the appearance of a Japanese tiler near Tokio.

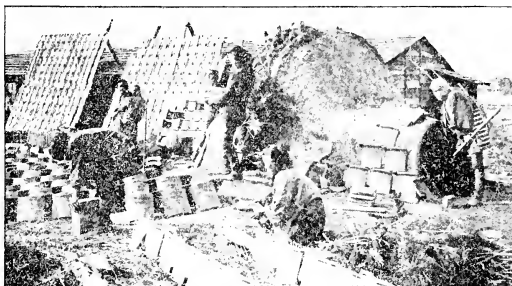


FIG. 84.

SUMMARY AND CONCLUDING REMARKS.

The older roofing-tiles of the world group themselves into three distinct types, the normal or Asiatic tile, the pan or Belgic tile, which is an outgrowth of the normal tile, and the flat or Germanic tile, which is an independent form. The normal tile, the earliest known form, covers by far the greater number of roofs to-day. With few exceptions it is the only form of tile used in Asia, Asia Minor, Greece, Italy, Sicily, Spain, the countries bordering the southern shores of the Mediterranean, and all the Spanish and Portuguese colonies and countries in both hemispheres. This tile is also found in areas contiguous to the countries above mentioned.

The treatment of the roof covered with this tile in the Orient and in the Occident differs widely. In China, Korea, Japan, and countries to the south of China the ridges are usually conspicuous for their elaborate structure. The tiles are aligned with great care, the eaves tiles have turned margins of graceful outline with ornamental designs upon them in relief. The roofs of the more important buildings have their ridges, hips and eaves in strongly curved lines and with this treatment the curved tegula is in harmony. In the Occident, one sees but little attempt at architectural effect in the treatment of the tile. The ridge is rarely more than a single course of semi-cylindrical tiles, though in certain Swiss and English glazed ridge tiles of a few centuries ago finials were moulded upon them. The eaves tiles differ in no respect from those of the roof and the only attempt at decoration was by the introduction of stucco or white plaster between the courses, as occasionally seen in modern Grecian houses and mediæval Spanish ones. In ancient Greece the ridge and eaves tiles, the huge discs terminating the ridges, the antifixæ, etc., decorated in polychrome, added greatly to the beauty of the roofs.

The discovery by Græber, on the site of the earliest example of Greek architecture, of a fully developed normal tile with curved tegula, and disc-closed imbrex, identical with that of eastern Asia, compels one to believe that from the far East came the roofing-tile. The curved tegula would naturally harmonize with the curved lines of the Eastern roof, while a straight-edged tile would be more in accordance with the straight lines of the Greek roof, and as a matter-of-fact, we find the curved tegula soon yielding to the broad flat tegula, which ever after became the dominant form for the monumental buildings of ancient Greece, Italy, Sicily and Etruria.

Successive invasions of the Asiatic tile, in a measure, supplanted the normal flat type which seemed at the outset to be associated with monumental buildings, though this purely classic form has survived in the modern flat type seen in Italy to-day. The circular disc closing the imbrex points distinctly to eastern Asia, and the subsequent decoration of the eaves and ridge tiles, while strongly suggesting an Eastern origin, is no sure criterion, as to whatever the Greeks touched they imparted a charm derived from their own matchless instinct for the beautiful.

It seems curious to see the antifixæ attached to the eaves tiles, at Assos, as late as the Roman epoch, and yet 600 years before, at Selinus, these elements had already become detached from the roofing-tiles and were independent pieces, nailed to the top of the stone coping.

The historical sequence in the development of the early Grecian, Etruscan, Roman and Sicilian tile, and the source of the first form—the *norm* as Graeber describes it—so common in China to-day, must ultimately be cleared up. The material is indestructible and the character of a fragment, even, is easily recognized.

It has been impossible to find data indicating, even approximately, the first appearance of the pan tile and the flat tile, though it is probable that these data exist.

The geographical distribution of these three types of tile to-day is a matter easily ascertained and I venture to present the following map of Europe (fig. 85) upon which are indicated by conventional lines the regions where these various forms occur. These lines represent the appearances of the tiles in section and will be readily understood. The single curved lines represent the normal tile, the lines of double flexure the pan tile, and the short, straight lines the flat tile.

As the normal tile is almost universally distributed in

Asia, it was unnecessary to represent that region of the world.

Sources of information.—The preceding notes have been derived from personal observation in most of the countries mentioned, except in India and Persia and those countries immediately bordering on the Mediterranean. For these countries, particularly Italy and Greece, I have depended upon photographs. Many of these examined were of large size, and presented the most reliable details; even when of small

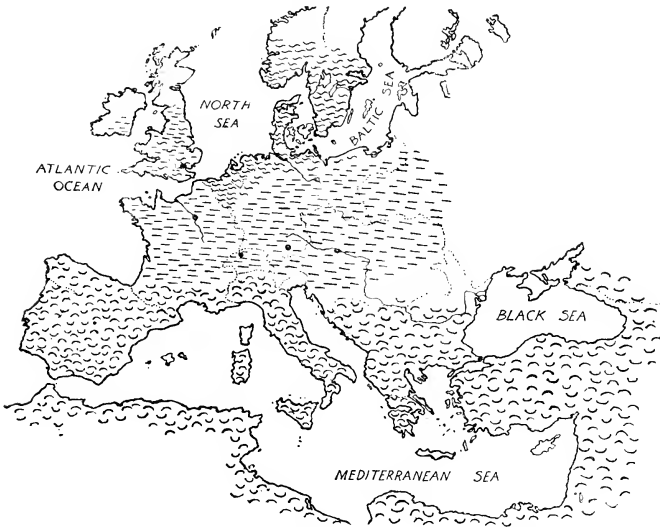


FIG. 20.

size, the type of tile could be easily made out with the aid of a lens. Reproductions from sketches illustrating architectural tours, etc., could not be depended upon, as the roofs in these drawings were usually represented by rough, shaded surfaces or formal lines. The art-galleries in Berlin, Dresden, London and other places were good hunting-grounds to fix the date of the use and distribution of the roofing tiles (as, for example, a picture by Botticelli in the Dresden Gallery, of the thirteenth century, showing the flat, normal tile of Rome;

a picture of the Sienese school, twelfth century, in the National Gallery, London, showed a similar tile. The old Dutch masters present the pan-tile, and Teniers shows the angular ridge-tile on a thatched roof).

Collections of photographs, however, furnish the best material when one cannot visit the country; the only drawback is that such pictures usually present monumental buildings, often roofed with metal, and it is only by chance that the roof or ridge of some common house comes into the picture. For the photographic and other material I am greatly indebted to the collections of the Boston Museum of Fine Arts, Peabody Academy of Science. Salem, Gen. Charles G. Loring, Mrs. Helen Abbott Michael, Mr. and Mrs. E. F. Waters, Mr. T. F. Hunt, Mr. Sylvester Baxter, Mr. Denman W. Ross, Mr. J. Adamowski, Mr. A. E. Barber, Prof. C. C. Abbott, Mr. Alban Andren, Mr. G. E. Walters and others, whose names are mentioned in the text. My obligations are especially due to Mr. Edward Robinson for calling my attention to numerous memoirs on the Classical antiquities of Greece and for the use of his valuable Classical library.

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THE REPTILES OF THE GALAPAGOS ISLANDS.

From the Collections of Dr. Geo. Baur.

BY S. GARMAN.

CHELONIA, Sauria and Ophidia have been discovered on the Galapagos. Excluding the marine forms that may from time to time be found on the shores, only four families are represented: the Testudinidæ of the tortoises, the Iguanidæ and the Geckonidæ of the lizards, and the Colubridæ of the snakes. Neither is peculiar to the locality. The sea tortoises of the Chelonidæ are known to visit the beaches, and stragglers of the Sphargidæ may also be expected to wander there. Certain of the sea snakes, Pelamis, of the Hydrophidæ, frequent the waters nearer the continent and may at times be captured among these islands.

Two genera of the lizards, Conolophus and Amblyrhynchus, are found only on the Galapagos; their closest allies, however, are inhabitants of the western coasts of South

America. The other five, Testudo, Tropicurus, Phyllodactylus, Gonatodes, and Orophis, are genera of which very closely allied species are distributed along the same coasts.

Only one of the species discovered on the islands, *Phyllodactylus tuberculatus*, has not been distinguished from those of the continent. It ranges from Chile to California. The tubercles of Dr. Baur's specimen differ so much from those of the mainland form that the type may prove to be a new variety if not a distinct species. The balance of the species, though in cases but little differentiated, are sufficiently distinct for recognition among their continental allies.

The affinities and the amount of differentiation of the species on the various islands prove beyond question that the insular genera and species were derived from those of the nearest South American coasts, either somewhat directly and recently or more remotely, from common ancestors. While there is a general agreement in regard to the sources from which the different forms of plants and animals at present inhabiting the islands were primarily derived, the agreement is not extended to the manner of derivation. Advocates of the theory of independent, volcanic, origin of the archipelago claim that accidental introductions have established the flora and fauna, and explain the varying affinities of the types by asserting the transportation of the same or of different species to particular islands and by the effects of isolation and varied surroundings. They do not consider the six hundred miles or more of distance from the source of supply to be an insurmountable obstacle, and they are favored by the great Peruvian current and by the winds. Advocates of another theory hold that the islands once were mountains connected with what is now the continent by lower lands, that by subsi-

dence they became separated, and that the modern forms of life, with exception, perhaps, of one or a few of recent introduction, are simply the descendants of continental forms established in their present localities before the connecting lowlands disappeared in the ocean. In both theories, isolation and differences of circumstances were the important factors in differentiation; and the closeness of existing relationships may be cited in favor of each of the hypotheses.

The portion of the collection submitted to me for examination suffices for special determinations but is insufficient for purposes of generalization. It indicates that a most important contribution to the scientific history of the region might be made by one who is able to gather from each of the islands series large enough to supply the now-lacking means for comparisons. His most extensive series, that of *Tropidurus*, and the tortoises have already been studied by the Doctor himself. Among those identified in this paper his collection has added one genus, *Gonatodes*, and two new species, *Gonatodes collaris* and *Phyllodactylus Baurii*, to the list of those reported from these localities.

One of the most interesting specimens in the collection is a small *Conolophus* from Barrington. It is important because of the opportunity it affords for a description of the young, and because of the light it throws on the derivation of the genus. Its resemblance to forms of *Enyalioides* is so great that if larger individuals were unknown we should place it in that genus by the side of *E. laticeps*, as a closely allied species. A comparison of this specimen with others of species of *Enyalioides* makes it very evident that *Conolophus* was derived from one of their immediate ancestors, the nearest, perhaps, that of *E. laticeps*. *Conolophus* and *Amblyrhynchus* have close anatomi-

cal affinities, and they must have come from nearly allied forms, not from the same form. It may be that both of these genera developed on the same island, the arid belt near the shores evolving the cactus-eating *Conolophus* while *Amblyrhynchus* made its food of seaweeds. Or it may have been that *Amblyrhynchus* developed on one or more of the islands on which there was no alternative for the seaweed, whence the lizard has reached other localities in which it now occurs. How these saurians became possessed of the vegetarian habit is a question to which our only answer is conjecture. Its inheritance from herbivorous mesozoic progenitors that might have existed is not to be seriously considered. While it may have been the case that allied species on the mainland also to some extent fed on plants, it is more likely that scarcity of animal food rather suddenly brought upon them, whether through emigration or otherwise, compelled a change of diet. Such a change would be complete in a single generation; whereas more gradual diminution in the supply of animals might induce or permit adaptation, by reduction in size or needs, to correspond with the conditions. *Conolophus* with its feeding habits could only develop in such places as now harbor it, the higher of the islands, those surrounded by the cactus-bearing arid belt and possessing the fertile upper plateaus. By this fact it is restricted to a few of the islands. But *Amblyrhynchus* is equally at home on any of the islands with sufficient shoal water around them for the production of the seaweeds. It may have started on one of the islands that have no fertile upper belts, which are not high enough to arrest the moisture needed for vegetation. However it reached such a territory it would be obliged to depend on the beaches for subsistence, and from such a place it might spread over the entire archipelago.

The determinations Dr. Baur has reached in his studies of the genera *Testudo* and *Tropidurus* are the following:

TESTUDO.

- T. ELEPHANTOPUS Harl. (*T. vicina* Gthr.) Probably James.
 T. MICROPHYES Gthr. Albemarle.
 T. ABINGDONII Gthr. (*T. ephippium* Gthr.) Abingdon.
 T. GALAPAGOENSIS BAUR. (*T. elephantopus* Jack.) Charles.
 T. NIGRITA Dum. Bibr. Locality unknown.
 T. GÜNTHERI BAUR. (*T. elephantopus* Gthr.) Locality unknown.

TROPIDURUS.

- T. GRAYI Bell. Charles.
 T. BIVITTATUS Pet. (*T. lemniscatus* Cope.) Chatham.
 T. INDEFATIGABILIS BAUR. James & Indefatigable.
 T. DELANONIS BAUR. Hood & Gardner.
 T. DUNCANENSIS BAUR. Duncan.
 T. ALBEMARLENSIS BAUR. Albemarle.
 T. PACIFICUS Steind. Abingdon.
 T. HABELII St. Bindloe.

In connection with this genus I may add an interesting note obtained from Count L. F. de Pourtalés in a conversation after his visit to the Galapagos on the Hassler Expedition. He stated that one day as he was sitting on a rock on the shore of one of the islands he saw a hawk stoop for one of these little lizards running back and forth on the sands. At once on the approach of his enemy the lizard rushed into the water and remained there until the hawk had gone away. So far as I am aware no notice has heretofore been made of a disposition on the part of species of *Tropidurus* to enter the water.

Below are given the determinations and notes secured by a study of the remainder of the Doctor's collection.

CONOLOPHUS SUBCRISTATUS Gray; St.

A specimen from Barrington has a length of body of four and three-fourths and of tail seven and one-half inches.

It is handsomely marked and bears a striking resemblance to species of *Enyalioides*. This is apparent even in the gular sac and the transverse fold on the throat, and suggests that in our systems these genera are placed too far apart. The coloration differs materially from that of the large specimens. The ground color is of a light olive, lighter and uniform beneath and blotched and vermiculate on the back. Between the nape and the hips on the middle of the dorsal surface there is a series of eight lighter centred, brownish transverse bands, and between these and at their sides on the flank there are streaks forming vermiculations or rings. The rings enclose spaces of the ground color; on the lower parts of the flanks they are larger and more distinct, resembling in a measure those on the flank of *Enyalioides planiceps* as figured by Guichenot. The crown of the head bears scattered spots of black. The tail is brown on the top; on the middle of the side it has a more or less broken longitudinal streak of the light color, below which there is an irregular narrow band of brown separating it from the lighter color of the lower portion.

Size and color are the features in which differences are to be detected between this specimen and the larger ones. Those that obtain are such as will disappear with age. The several large individuals from the same island nearly approach a number secured by the Hassler Expedition, for the Museum Comparative Zoology, from Albemarle. The most notable of the differences between them appear in the higher labials, as compared with the length, and in a more concave frontal region on the specimens from Barrington, which probably represent a distinct variety of the species. The largest is about forty-two inches in length, half of which is tail.

Concerning the dorsal crest there are several items it may be well to notice here. In all cases the crest nearly

or quite disappears between the hips, and on the males it attains a greater development. Each of the large spines of the neck has a small one immediately in front of it, and frequently the latter is preceded by a still smaller one. While young the spines are subpyramidal, convex on the sides and concave behind, but as they grow higher they become more subconical. Early in life the growth is rapid and steady; later it takes on a periodicity that is plainly indicated in the dorsal spines. Those on the Barrington specimens are encircled by three to six ridges, like the rings around a cow's horn. These make the outward appearance of each spine resemble that of the rattle of a small rattlesnake. In a longitudinal section, however, the layers of the epiderm are seen to lie closely against each other, not loosely as in the rattle. When with age the shape of the spine becomes subconical, a slight constriction around the base of the cap, or slough, prevents its removal. The periodic growth of the skin lengthens the spine thus pushing the older cap farther out so as to expose a portion of the base of the new one formed within it. The entire spine being dermal there is no vacant space within the successive caps, consequently, close as the external resemblance is, they do not assume the function of rattles. The appearance is brought about by the shape of the cap, or slough, and the periodicity of the growth. Though not a rattle it confirms my account of the structure and development of that organ as given in 1888 (*Bull. Mus. Comp. Zool.*, XIII, 259). Retention of the several caps adds to the firmness and rigidity of the spine. On one individual the longest spines measure three quarters of an inch.

AMBLYRHYNCHUS CRISTATUS Bell.

Dr. Baur's Collection contains specimens from Albatross, Bindloe, Charles and Tower, and in this museum

there are others from Albemarle, Charles, Duncan and Jervis islands. All may be placed in a single species, in which it seems possible, however, to distinguish three varieties: first, the typical form of the species, *A. cristatus*, with the young profusely mottled with whitish, greenish and olive and the old reddish, mottled, and clouded with darker on the sides and usually with a black blotch between the shoulders (from Albemarle, Bindloe, Charles and Jervis); second, *A. ater*, the large black form, from Duncan, which exhibits, in large specimens, little or none of the russet color or the mottling; and, third, *A. nanus*, a small black form from Tower island, a form that does not appear to reach half the size of that from Duncan, and which becomes nearly uniform black at a size that in *A. cristatus* has more of green and olive than brown. The smallest specimen of *A. nanus* is five inches in length of body and seven and one-fourth in length of tail; the largest has a body eight inches long and a tail twelve and a half. Two specimens of *A. ater* were secured by Professor Agassiz, on the Albatross, from Duncan. The larger is fourteen inches in body and eighteen and a half in tail. The color distinguishes them at once from *A. cristatus*. Of the latter those from Charles appear to have more of the lighter colors in the young, but in the old there is little difference to be detected between the several localities. The smallest specimen, from Albemarle, measures four and a half inches in body and five and three-fourths inches in tail. It has eight or nine transverse bands, or series of lighter spots, from nape to base of tail, is mottled with lighter on flanks, and is coarsely punctulate with brown under throat and breast. On the small ones the tubercles of the head are light colored, and spots of the same color form a sort of rosette on the nape. The tubercles of the forehead are flat or convex scales at first, later they become carinate

and finally subconical. On the dorsum the crest is first indicated by convex scales that become compressed and ultimately subconical or pointed. In this genus the crest on the neck shows the appearance of the rattles more than that on the back, the opposite of what occurs on *Conolophus*.

While looking over the specimens belonging to the Museum of Comparative Zoology with Count Pourtalés, he mentioned a statement of Darwin to the effect that this species does not take to the water for safety, but that when Darwin had thrown them in they immediately returned to the shore. The Count said that, from his own observations, among large rocks where there were fishes the lizards preferred to hide in crevices on shore; but that he saw them along the open places, where there were numbers of them, run into the sea, near the beach where the water was shallow, and secrete themselves under the rocks when pursued from the land.

PHYLLODACTYLUS TUBERCULOSUS Wieg.

This identification may yet be questioned. The specimen in the collection, from Chatham, is badly mutilated. It agrees with Wiegmann's species in the distribution of the tubercles but differs in their shape and size; they are broader and flatter with the keel more distinct from the rest of the upper surface.

PHYLLODACTYLUS GALAPAGOENSIS Pet.

Dr. Boulenger gives the locality of this species as Charles Island. Dr. Bair's specimens are all reported from Albe-marle, where it would from his collections appear to be the only species of the genus. The largest individual measures three and three-quarters inches, indicating a smaller species than *P. tuberculosus*, of which specimens

of my collecting in the Daule region, above Guayaquil, reach five and a half. The dorsal tubercles are less developed, and those on the head and neck are less numerous than those of that species, while the large scales below the tail are not arranged in a regular series. Of ten specimens, five have three submentals in contact with the mental, as described by Peters; four of the others have but two submentals in the same position, as stated by Boulenger; and one individual has four submentals against the mental shield. In most respects the descriptions of coloration given by the mentioned authors accords with that present on these specimens. A striking contrast is presented by one example: its ground color is light and the markings are black; between the nape and the base of the tail there are eight transverse bands, bifurcating toward the flank; on the tail there are thirteen of the black bands; and the black band from the nostril through the eye is met at the ear by that from the nape. Ordinarily the dorsal blotches are brown, separated along the vertebral line, and reduced to two series of spots.

PHYLLODACTYLUS BAURI sp. n.

This species is still farther than the preceding from *P. tuberculosus*. There are but five rows of tubercles on each side and they are smaller and more irregularly placed in the rows. The scales of the back of the head and the neck are granular, as in *P. Reissii*. The mental is rather short; it is broad and forms an obtuse angle posteriorly, between two large submentals. The first infralabials are about one-fourth as large as the mental, by which they are widely separated. Forward from a vertical through the pupil there are six labials and five to six infralabials.

The colors and markings are like those of *P. galapagoensis*. The reduction or absence of the tubercles on the

neck brings this species close to *P. Reissii*, described by Peters from Guayaquil; the latter is readily distinguished by its mental shield which is almost entirely between the first pair of infralabials, and these are hardly smaller than the mental itself.

Hab. Las Cuevas, Charles Island.

PHYLLODACTYLUS LEEI Cope.

On one individual there are six labials in front of a vertical through the pupil on one side and seven on the other.

Hab. Chatham Island.

GONATODES COLLARIS sp. n.

Head moderate; snout obtusely pointed, longer than the distance between the eye and the ear opening, one and one-half times the diameter of the orbit, equal the width of the crown at the hinder edge of the orbit; forehead flat; ear opening small. Digits slender; basal joint slender, subcylindrical, with larger plates beneath; other joints more slender, compressed. Head, throat, upper portions of body, limbs and tail covered with subequal granular scales, smallest on the occiput, larger on chin and tail. Rostral broader than high, pentagonal, incised on the top. A small internasal toward each side. Two small shields behind the nostril. Six labials; sixth small, slightly behind the middle of the eye. Five infralabials; posterior nearly reaching a vertical from the hinder border of the eye; first large, in contact with two submentals; mental large, with a median and two lateral angles posteriorly, in contact with a pair of moderate submentals, at each side of which there is one scarcely half as large, from which again a diminishing series of three or four passes back along the infralabials. Abdominal scales moderate, imbricate, heptagonal, flat, similar to scales in front of thighs and arms.

Tail tapering, subround, covered with small imbricate scales above and larger ones beneath. The median row under the tail is subject to great variation: on two of the specimens the scales are about twice as broad as long; on two others they are so broad as to reach from side to side of the tail. The granules of the throat are fine, quite as small as those of the occiput; near the labials and submentals they rapidly increase in size.

Body and limbs dark brownish; back darker, with numerous small spots of light blue. A dark-edged spot of the blue above the shoulder. In front of each shoulder there is a vertical band of bluish that does not reach the median line on the top of the neck. Along the vertebral line the back is lighter, and along this light band there are five pairs of dark spots, and at the hinder edge of each of these spots there is a smaller one of the light color. The first pair of the spots lies transversely in front of the vertical band, the second behind the shoulders, the third near the middle of the body, the fourth in front of the leg, and the fifth across the base of the tail.

Chin and throat yellow to orange. Top and sides of head brown; with a yellow band from the angle of the mouth to the nape, another from the eye to the parietal region, and a third from the nostrils backward over the supraorbitals. On the crown the disposition of the yellow is irregular, but on each specimen there is a short median streak of the light color.

This form is very closely allied to Gray's species *G. ocellatus* from Tobago. The principal differences seem to be in the coloration. The vertical streak is in front of the shoulder, and to reach the latter would have to turn back at its lower end. The head is not so high, and the outline from rostral to occiput is very slightly but quite regularly curved. In the figure given, by Dr. Boulenger,

of *G. ocellatus*, the scales under the fourth toe are smaller toward the base; in our species they are about equal in size.

Hab. Wreck Bay, Chatham Island.

OROPHIS BISERIALIS.

Herpetodryas biserialis Gthr., 1860, Pr. Zool. Soc. Lond., 97.

Dromicus Chamissonis Pet., 1869, M. B. Berl. Akad., 719.

D. Chamissonis var. *biserialis* Gthr., 1870, Zool. Rec., vi, 1869, 115.

D. Chamissonis var. *dorsalis* and var. *Habelii* Steind., 1876, Schl. u. Eid. der Galap.-Inseln, p. 6, pl. 1.

Opheomorphus Chamissonis Cope, 1889, Pr. U. S. Mus., 147.

There is a single specimen of this snake in the collection from Hood Island. It is intermediate between Günther's species *biserialis* and Steindachner's variety *Habelii*. Structurally it agrees with the type described by Günther, but it has no spots on the back. The dorsal band is continuous, though fainter and indistinctly margined behind the middle of the length. The type from which the species was originally described was said to be from Charles Island. The present specimen from another locality possesses the squamation of one of the so-called varieties and the coloration of the other. This seems to me to indicate the existence of but one variety, of which the spotted forms and those with three postorbitals are individual variations. There is nothing in the published evidence to show that the striped form, the spotted form, that with two postorbitals, and that with three do not occur amongst the individuals of any of the localities inhabited by this snake.

Günther's type has three postorbitals and is spotted, Dr. Baur's specimen has three postorbitals and is striped, and Steindachner's varieties both striped and spotted have but two postorbitals.

Steindachner's specimens are from Charles, Hood, Indefatigable, and Jervis Islands, Baur's and Günther's are from Charles and Hood.

The species was first placed by Dr. Günther in *Herpetodryas*. Peters removed it to *Dromicus*. The type species of *Dromicus* is *C. angulifer*, with two scale pores, which differs too much to admit of including the Galapagos serpent with it in the same genus. *Liophis* was based by Wagler on *L. miliaris* or *L. Merremii*, and *Opheomorphus* thus becomes a synonym, being founded on the same type. Since Fitzinger, 1843, has applied the name *Orophis* directly to *O. Chamissonis* it would appear that the best way out of the confusion lies in retaining his generic designation for that species and others not generically distinct.

Orophis biserialis differs from *O. Chamissonis* mainly in having a larger number of scutes. Our specimen has 19 rows, no pores, 209 scutes under the body, a divided anal, a mutilated tail, one loreal, one anteorbital, three postorbitals, eight labials, and ten infralabials. The frontal does not widen in front; between the supraorbitals its sides are parallel. The lateral band of light color extends along the two outer rows of scales, and the upper light band is on the sixth and seventh rows. The dorsal band of brown occupies five entire rows with the adjoining edges of two others; the lateral bands of this color occupy but three rows with the adjoined edges of two more. All of the bands fade posteriorly. The lateral bands of brown begin at the nostrils and pass through the eye to the flanks; the dorsal band begins on the forehead, where it is not so dark. Anteriorly there are spots under the body; pos-

teriorly the spots do not appear and the color is more uniform white or yellowish. The edges of the scales are darker. The greater part of the brown in the coloration is in the shape of coarse punctulations; these are continued more or less completely across the abdomen on the hinder edges of the scutes. On its edges the dorsal band has the appearance of being serrated. Dr. Günther found 209 ventral scutes on the type specimen. Steindachner found the ventrals on his examples to vary from 219 to, 225 and the subcaudals from 105 to 114. On *O. Chamissonis* the ventrals vary from 175 to 201 and the subcaudals from 100 to 113.

Mus. Comp. Zool., Jan., 1892,
Cambridge, Mass.

ON REPTILES COLLECTED BY DR. GEO. BAUR
NEAR GUAYAQUIL, ECUADOR.

BY S. GARMAN.

THOUGH it contains but few types, this collection is of interest because of the means it affords for determining a number of individual variations, and for perfecting to some extent several of the original descriptions, and also for reducing the number of nominal species. The specimens were secured either in the immediate vicinity of Guayaquil or, along or off the coast, on the way from that city to the Galapagos Islands.

PELAMIS PLATURA Linn. ; Garm.

Four specimens of this sea snake were taken opposite Santa Helena. The first has 53 scales in a row around the body near the middle, nineteen of them being included in the black color of the back. In a row from the chin to the tip of the tail there are 344 on the body, and 52 on the tail. Around the middle of the tail there are 27 rows. On each side of the head a large anteorbital reaches from the prefrontal to the lower of the two postorbitals. None of the labials reach the orbit.

On the second there are 56 scales in a row around the middle of the body ; and in a line from the chin to the end of the tail there are 355 scales on the body, and 48 on the tail. Seventeen of the scales around the body are in the

black. In this case there are two anteorbitals on each side, the lower one extending between the orbit and the labials to the lower of the two postorbitals. In the middle of the yellow color of the flank a black band passes back from the lower jaw over more than one-third of the length; behind this it becomes a series of large spots; and these latter, toward the tail, extend downward to the median ventral line and join the spots from the opposite side to form transverse bands.

The third example has 53 rows, nineteen of them in the black, and in the ventral series has 340 on the body, and 45 on the tail. On one side of its head there is one anteorbital, which is separated from the lower of the two postorbitals by the fifth labial. On the other side there is a single postorbital; this is separated from the lower of the two anteorbitals by the fifth labial. There are eight labials, of which the fourth is small and crowded under the third and fifth. Infralabials 11-12.

The fourth individual has 53 rows of scales, seventeen of them black; and in the ventral series there are 351 on the body, and 49 on the tail. It has two anteorbitals on one side, the lower one united with the fourth labial and extended below the eye to the lower of the two postorbitals. On the other side it has two ante- and two postorbitals, with a large suborbital between the eye and the labials.

Only one of the four specimens has black in the yellow of the flank. On two of them the black of the back is regular in its lower margin to the base of the tail, where it breaks into rounded blotches which descend on the sides and alternate with others extending up from the lower edge of the tail. On the other two the black of the back becomes sinuous in its lower edges, not far from the middle of the body, and breaks up on the tail, where scattered small spots of black appear.

LEPTODEIRA ANNULATA Linn. ; Fitz.

Considerable individual variations are shown by the eleven specimens in the collection. Six have 21 dorsal rows; five have 23. The scutes range from 185 to 194, averaging about 189. The average of the subcaudals is nearly 82, the range being from 72 to 90. The normal number of labials is eight, on one side of each of two specimens there are nine. There are ten infralabials; on both sides of one specimen and on one side of each of two others there are eleven. Normally there are two ante- and two postorbitals, and the fourth and fifth labials enter the orbital ring. On one side of one specimen there is a single anteorbital and the third, fourth and fifth labials enter the orbit; and on both sides of another there are three postorbitals, while on one side of the same specimen there are three anteorbitals. The dorsal blotches vary from 40 to 54 on the body, averaging about 45; and those on the tail range from 17 to 25, with an average of about 22. On some the dorsal blotches are transverse, undivided on the median line; on others they seem to be divided above the vertebræ and alternated and joined in such a manner as to form a sinuous line, crossing back and forth from side to side of the dorsum for a considerable extent of the entire length. In young stages the ground color is much lighter and the spots are more distinct. The scales have two pores; anal and subcaudal scutes are divided.

HERPETODRYAS BRUNNEUS Gthr.

Rows 17, pores 2, scutes 155 + 122, and 154 + 131, anal and subcaudals divided; labials 9, infralabials 10, a loreal, one anteorbital, postorbitals 2, three on one side of one specimen, fourth to sixth labials in the orbital ring. The length of one is $11\frac{1}{2} + 6\frac{5}{8}$, and of the other $19\frac{1}{2} + 13$ inches.

On the younger the light vertebral space is more distinct, as also the narrow bands of darker at each side of it, in which there are small black spots. On the larger the color is a darker olive in which many of the scales are tipped with black. Nine of the dorsal rows are keeled.

HERPETODRYAS RETICULATUS Pet.

A young specimen with 17 rows of scales, 186 ventral scutes, a divided anal, and a mutilated tail. Labials 9, infralabials 10, one anteorbital, postorbitals 2. The fourth to the sixth labials are in the orbital series. To the base of the tail there are 82 blotches. Ventral surface without black spots; no white spots or white-edged scales on flanks or back. In the quadrangular blotches of the back the central portions are lighter, as also of the scales. This form is evidently closely allied to *H. Rappii* of Günther.

CONIOPHANES SIGNATUS sp. n.

Body slender, elongate, slightly depressed. Head little wider than neck, crown flattened, snout moderately pointed, loreal region concave. Scales smooth, lustrous, elongate, poreless, in 19 rows around the middle of the body. Ventral scutes 132, anal and subcaudals bifid, tail mutilated. Rostral not bent back on the snout. Internasals not half as large as prefrontals, broader than long. Prefrontals large, broad, bent down to the loreal. Nasals two, loreal as high as long, labials 9, fourth and fifth in orbit, eighth small, not as large as the loreal, longer than high, seventh and ninth large, one anteorbital, two post-orbitals, infralabials 10, two pairs of submentals. The maxillary teeth increase in size backward; the posterior one is grooved. A dorsal band of brown occupies five scales, and a half scale at each side of these; a light line

at each side of the dorsal band includes two entire and two half-scales, and the brown band at the lower edge of each flank covers the three outer rows, the half of the fourth, and the ends of the ventral scutes. In the dorsal band there are two narrow streaks of light color, on the middle of the scale, and on the lower band of the flank there are three similar streaks, the upper two of which are close together. On each side of the nape there is an oblong area of lighter color surrounded by dark, and the outer portions of the temporals are lighter. The dark brown of the middle of the crown extends forward on the frontal, forming a trident with the prongs in front, ending on the prefrontals. A dark band passes through the eye to the neck; below this a light band passes back into the pair of white streaks in the second and third rows of scales. Lips, chin and throat thickly freckled with brown. A peculiar feature of this snake is the smallness of the eighth labial as compared with the ninth or the seventh. It is longer than high and lies below the lower temporal which is larger than the upper and passes downward between the seventh labial and the ninth to the eighth. The specimen is alike on both sides of the head.

OXYBELIS AENEUS Wagl.

Labials seven to eight; infralabials nine. From Posorja.

CNEMIDOPHORUS LENTIGINOSUS sp. n.

Head narrow. Nostril anterior to the nasal suture. Each of the outer parietals transversally divided into three. Four supraoculars, the posterior two and half of the second separated from the frontal and the fronto-parietal by a line of granules, six to seven supraciliaries, a freno-orbital, median gular scales enlarged, mesoptychium with four or five rows of enlarged scales, smaller but not gran-

ular toward the edge of the collar. Dorsal granules small, uniform. Ventral plates in ten longitudinal and about thirty-four transverse series. Five large plates forming a triangle, from the vent $2 + 2 + 1$, at each side of which there is a series of five smaller ones. Three or four rows of brachials, anterior largest and continuous with the largest, posterior, of the two rows of antebrachials. Eight to ten rows of femorals, two or three of which are large; tibials in three rows, outer largest. Femoral pores twenty to twenty-one on each side. Male without anal spines. Caudal scales slightly oblique, carinate, subtruncate posteriorly. Length of body, 4.25, of tail, 7.75 inches.

Back olive brown, tinted with red anteriorly; upper surface of body and limbs and sides of head thickly sprinkled with small rounded spots of yellowish or white, apparently arranged in both longitudinal and transverse series; top of head lighter brownish, uniform; a series of spots from ear to rostral on the labials; lower surface olive, reddish on chest and folds, yellowish under legs, tail and hinder parts of abdomen. A faintly indicated light streak extends from the supraciliaries back above the hips.

Hab. San Francisco de Posorja.

AMEIVA EDACANTHA Boc.

A small posterior, fourth, supraocular is present in each case. Supraciliaries five to six. Granules scarcely intervening between fronto-parietal and supraocular. Pores twelve to thirteen. Throat of male red-tinted. Males with six large and several smaller spines in each group at the sides of the preanals.

Hab. Posorja.

IGUANA TUBERCULATA Laur.

Secured at Posorja.

TROPIDURUS OCCIPITALIS Pet.

Tropidurus (Lamoprists) occipitalis Peters, 1871,
M. B. Berl. Akad., 645.

Aneuporus occipitalis Bocourt, 1874, Miss. Sci. Mex.,
Rept., 215, pl. xviii, fig. 1.

Craniopeltis occipitalis Cope, 1876, Jour. Phil. Ac.,
(2), VIII, 173.

Tropidurus occipitalis Boulenger, 1885, Cat. Liz., II,
173.

Tropidurus Bocourti Boulenger, 1885, Cat. Liz., II,
173.

On the shields of the snout the keel is very feeble or absent. The supraorbitals have faint striæ. Frequently, especially in the young, the occipital black spot is bordered by white. The dorsal crest is very prominent on old males; it is less so on the females, and is indicated by broad scales with a median keel, but without the acuminate point, in the young. On the larger ones there are four (4-6) acute scales on the front margin of the ear. Behind the arm, extending back along the flank the male in life has a group or band of red spots. The females and the young do not show this but they have a narrow band of lighter color from the upper edge of the arm to that of the thigh. The humeral fold is usually black inside. Females and young have the fold in front of this of a brilliant red color. On the female the dorsal blotches are much reduced and less distinct. On the male the four blotches of the scapular region are large and jet black. The young ones have eight or nine moderately distinct transverse bands of brown between the nape and the base of the tail, the series becoming more faint as continued farther back. The two light bands along each flank are very distinct on the young.

Young ones closely resemble *Scelopori* in appearance and coloration.

Bocourt's genus *Aneuporus* appears to have been founded on the female of this species. Cope's *Craniopeltis* is apparently the same. From their descriptions Boulenger was led to found the species *T. Bocourtii*, which, from the evidence of Dr. Baur's specimens, becomes a synonym of *T. occipitalis* of Peters.

From San Francisco de Posorja, on the north side of the gulf, between Guayaquil and Point St. Helena.

PHYLLODACTYLUS TUBERCULOSUS Wieg.

From Guayaquil.

Mus. Comp. Zool. Feb., 1892, Cambridge, Mass.

ON COPHIAS AND BACHIA.

BY S. GARMAN.

Cophias as a generic name for South American reptiles dates from 1820, when Merrem, *Syst. Amph.*, applied it to a genus of the Toxicophidia. Of the species he included four or five rightfully belonged to previously established genera. After removing those of *Lachesis*, Daudin, 1803, and *Trigonocephalus*, Oppel, 1810, there remained but two to bear the name proposed by Merrem. Wied-Neuwied in his *Reise*, 1821, in his *Abbildungen*, 1824, and in his *Beiträge*, 1825, uses this name for species correctly placed with these. Wagler, 1824, in the *Spix Reptilia* gave the name *Bothrops* to a genus containing *Lachesis* and a number of species belonging with the two from Merrem and those of Wied, through which *Cophias* really anticipates Wagler's name, though that term has been adopted by recent authorities.

Previous application and repeated use among the Ophidia notwithstanding, Fitzinger, 1826, *Syst. Rep.*, 20, gave the name *Cophias* to a genus of lizards, distinguished by three toes on the hind foot. The only question in this note is whether we are justified in retaining this name among the Sauria. From the data given above it does not seem possible to do so in accord with general practice. In fact the necessity of selecting another title for the genus of lizards so named appears unavoidable. If we accept the genus

as constituted by Dr. Boulenger, 1885, Cat. Liz. Brit. Mus., II, 417, we find that because of application elsewhere neither Chalcides, Chaleis, Colobus, nor Microdactylus, sometime applied to one or others of the species, is available, and we must turn to the next in order. One of the included species, that described by Duméril and Bibron, 1839, Erp. Gén. v, 462, Chalcides D'Orbignii, was made the type of the genus Bachia by Gray, 1849, Cat. Liz. B. M., 58. At the time this was the only species. Boulenger, 1885, determines that three others are congeneric. By extending the limits of the genus so as to include them, and leaving the name Cophias to the snakes, we shall solve the difficulty and preclude further confusion. At present the following species are placed in Bachia :

<i>B. D'Orbignii</i> D. & B; Gray.	Chile ; Venezuela.
<i>B. flavescens</i> Bonmat. sp.	Guiana ; Venezuela.
<i>B. heteropus</i> Boettg. sp.	Central America.
<i>B. tridactylus</i> Daud. sp.	Hab ?

Mus. Comp. Zool., Cambridge, Mass.

ON TEXAN REPTILES.

COLLECTED BY MR. F. W. WAMSLEY FOR PROFESSOR J. W. P. JENKS,
CURATOR OF THE MUSEUM AT BROWN UNIVERSITY.

BY S. GARMAN.

MR. WAMSLEY'S collection was gathered at Deming's Bridge in Matagorda county, one of the gulf series of counties, situated eastward from the central meridian of Texas. In all, the lot contained seventy-two specimens, representing twenty-eight species of nineteen genera. Twenty-one species of fourteen genera were snakes, three species of three genera were lizards, and four species of two genera were tortoises. On account of the larger number of specimens and of the comparisons with descriptions given by Baird and Girard, many of whose types were secured in localities not far from Deming's, the greater interest attaches to the serpents. It will be noticed that the statements of the mentioned authors are closely approached by the data noted in this list.

As there appears to be no other way to secure anything like permanence in the names applied, it is thought advisable to trace the nomenclature back and to determine them in strict accord with the rules applying in regard to priority.

CHELONIA.

CISTUDO ORNATA Ag.

On one of the specimens the areolæ are so much raised that, with the radiating yellow lines, the scales in a measure

resemble those of *Testudo radiata*. An individual with a carapace measuring four and one-half inches in length by three and one-half in width has less than fourteen lines of growth on each scale. The top and the sides of the head are flecked with small round spots of yellow. In all cases the vertebral keel is obsolete.

CISTUDO CINOSTERNOIDES Gray; Garm.

Dr. Boulenger has examined the type of Gray's *Emys kinosternoides*, 1831, and, finding it to be identical with *Cistudo triunguis* of Agassiz, 1857, makes it a variety of *C. Carolina*. Of one of our specimens the head is yellowish green on the top and the sides with a faint yellow spot or two far back on the top and a few larger ones on the sides behind the ears. This one is less than four inches in length of carapace and the scales are smooth, or with traces of striae posteriorly. On the carapace the brown color is dark and the yellow is reduced to scattered small rounded spots; on the plastron the yellow spots are elongate or form short bands, but this color is much less in amount than the brown. Another specimen, with a shell five and a half by four inches, has the head of a chestnut-brown on top and sides, freckled with a few small spots of orange behind the mouth. The carapace is chestnut-brown, darker on the areolæ and the posterior borders of the scales on each of which there are faint traces of radiating lines of lighter color. The plastron is yellowish, darker in the sutures. Except in the lack of markings on its head this individual agrees closely with that figured by Wied as *C. Carolina*, apparently also a three-toed specimen. Each specimen in the collection has the labial scale of orange color with dark edges.

Objections are urged against the use of the name *Cistudo* as it was originally, as also *Terrapene*, a synonym for

Emys or *Emydes* of Brongniart. If we are to discard it, the next available name would seem to be *Emydoides* (orig. *Emyoides*) of Gray, 1844; or if this be put aside for lack of a diagnosis we shall have to adopt *Onychotria* of Gray, 1849, which is manifestly inappropriate for the majority of the species to be included.

TRACHEMYS TROOSTII Holbr. ; Ag.

These examples do not differ greatly from others taken in Mississippi. There is some variation among the specimens in regard to the narrow longitudinal lines on the head and neck, one having them broken up into mottlings. On the sides of the head and beneath, the lines are more or less irregular and broken. The scales of the carapace have black margins. In general the appearance is very dark, almost black. Under the plastron there is a considerable of a mixture of dark brown, brownish and yellow of various degrees of depth, the darkest color following the sutures. One of the shells measured nine inches in length by six and seven-eighths in width.

A lot of nine eggs was taken, on the twenty-third of May, which presumably belongs to this species. The shape is similar to that of *Ptychemys mobiliensis*, as figured by Agassiz; the size is a little greater. The largest in this lot measures one and eight-tenths inches in length by one and one-tenth in width. The smallest was one and sixty-five-hundredths inches by one inch. Another lot contained eleven eggs; the largest, one and sixty-three-hundredths inches by one and four-hundredths; the smallest, one and forty-seven-hundredths by one inch.

TRACHEMYS ELEGANS Wied ; Ag.

The shell measured six and twenty-five-hundredths by five inches. The free portion of the longest claw was five-eighths inches long.

SAURIA.

PHRYNOSOMA CORNUTUM Harl. ; Gray.

LYGOSOMA LATERALE Say ; D. & B.

The specimen has thirty scales in a row around the body, a smaller scale at each side of the pair of large preanals, and a pair of narrow lines of brown from the nape to the base of the tail along the middle of the back.

OPHISAURUS VENTRALIS Linn. ; Daud.

One hundred and twenty-seven scales from chin to vent. Eleven labials.

OPHIDIA.

SISTRURUS CATENATUS Raf. ; Garm.

One specimen had dorsal rows 25, ventral scutes 157, subcaudal scutes 25, labials 12, infralabials 13, and dorsal blotches 41, on the body, plus 7 on the tail. Another had rows 25, ventrals 155, subcaudals 3 pairs plus 31 entires, labials 13-14, infralabials 12-13, and dorsal blotches 43 on the body and 8 on the tail.

SISTRURUS MILIARIUS Linn. ; Garm.

Rows 21, scutes 134, subcaudals 25 entire plus 6 pairs, labials 8-9, infralabials 9, anteorbitals 3, postorbitals 5. The red band on the back is very distinct.

ANCISTRODON PISCIVORUS LaC. ; Cope.

Five specimens. Rows 25, scutes 135-137, subcaudals 39-44, labials 7-8, infralabials 10-11. The number of bifid subcaudals under the end of the tail varies from six to twenty, among them there are occasional entire scutes. A half scute frequently occurs immediately in front of the left half of the anal.

Comparison of these with specimens from the eastern section of the range discovers no grounds for separation as

a variety. On individuals there is considerable variation in the width of the lower edge of the second labial; in cases it approaches an acute angle at the mouth, where in others it presents a broad margin. But one of the labials enters the orbit. On a specimen in the Museum of Comparative Zoology the second labial presents a sharp angle downward but does not reach the mouth. Mr. Wamsley's specimens show the tail to be dark and the bands to be almost obsolete on the backs of the larger ones but very distinct on the young. The band behind the eye is distinct on the small ones; with age it becomes indistinct on its upper edge.

Baird and Girard give 145 scutes for *A. pugnax* and 140 for *A. piscivorus*; our highest number is 137.

ELAPS FULVIUS Linn. ; Cuv.

Three specimens. Ventrals 207, 212, and 213; subcaudals 40, 41, and 42, bifid; labials 7; infralabials 7. On one the yellow bands number $24 + 3$, on each of the others $22 + 3$. One red band is nearly as wide as one black plus two yellow ones. The tail is black and yellow only. The lengths are $22 + 3$, $19.5 + 2.75$, and $17.5 + 2.5$ inches.

Compared with others from the southern states east of the Mississippi, these specimens show plainly that *Elaps tristis* of Baird and Girard was founded on insufficient grounds. They are not distinguished by the shape of the heads. On a series from South Carolina the scutes number 204, 206, 208, 211, and, on a large female, 222. Others from Florida have 208, 209, 209, 210, and 225; one from Georgia has 208; and one from Alabama has 211.

ELAPS TENERE B. & G.

A single specimen in the collection may be placed in

this species. It has 229 ventrals, and 29 bifid subcaudals. On one side there are seven labials, second and third in orbit, on the other there are eight, third and fourth in orbit. There are 24 + 2 yellow rings; the red are much spotted with black, and each is about as wide as one of the black plus two of the yellow. Tail black and yellow.

TROPIDONOTUS OBLIQUUS Hallow.

This type agrees with *T. fasciatus* in structural details, but differs greatly in coloration. Rows 23, ventrals 132, labials 8, infralabials 10-11, 1 anteorbital, 3 postorbitals. Across the back there are about sixteen blotches of black separated by irregular obliquely transverse narrow streaks of yellowish that widen on the flanks. Toward and on the ventrals the blotches become reddish and more or less bifid. The first blotch is a wide one and extends forward on the neck and top of the head to the rostral. The margins of the labials have very little of the brown color, and the bar behind the eye is partially obliterated and indistinct. In the Mus. Comp. Zool. there is another specimen of this form, from Dallas, which has rows 23, scutes 135, subcaudals 77, labials 8, and infralabials 10-11. On this one the brownish red of the blotches extends nearly half way across the lower surface. Tail uniform dark brown.

This form is close to the type described by Hallowell from Kansas, but differs in the number of blotches, unless they are counted along the outer rows of scales on the flanks. His specimen had 140 ventrals, 69 subcaudals, and 32 + 18-19 blotches. On the young no doubt the blotches are less confluent.

TROPIDONOTUS TRANSVERSUS Hallow.

Of ten specimens the first two have 23 rows, the third 27, and the remainder 25 rows each. Their scutes, anal

and subcaudals being bifid, number 142 + 75, 146 + 78, 143 + 65, 148 + 71, 151 + 72, 148 + 70, 150 + 68, 150 + 74, 144 + 77, and 147 + 76. Commonly there are eight labials and ten infralabials; the latter vary from ten to twelve. One specimen has two anteorbitals on one side. Another has two postorbitals on one side instead of the usual three. Several have the scales of chin, snout and lips roughened with small tubercles or papillæ. The dorsal blotches vary from 31 to 36, and the caudal from 19 to 23. On the large ones the color of the back becomes nearly uniform dark brown. Small ones have a lighter ground color, blotches more distinct, and the two parietal yellow spots usually present. The tendency to form transverse bands is not so evident in this species as in its nearest ally *T. sipedon*. Beneath the anterior margin of each scute, toward the sides, there are crescent-shaped spots of dark color; on some of the older ones these spots have widened and lengthened until nearly the whole scute is covered; on other individuals these spots are nearly obsolete. A frequent variation in species having the bifid anal is to be seen in several of these specimens. In the anal scute the dividing line is oblique, and extends back and toward the right side, thus making the left portion the larger. It is in front of this, the larger half, that a small supplemental or half-scute appears. Two of the ten before us have a half scute in front of the left half of the anal, and a third has a smaller piece which does not quite reach from the median line to the lateral rows.

This is the species named *Nerodia Woodhousii* by Baird and Girard, 1853. Hallowell's name was applied in 1852.

THAMNOPHIS SIRTALIS Linn.; Garm.

Labials 7, infralabials 10, 1 anteorbital, postorbitals 3, and rows 19 in each of the four specimens. The ventrals

and subcaudals number 147 + 74, 142 + ?, 139 + 74, and 149 + 86. In a dorsal series the spots range from 73 to 82.

This genus is *Eutænia* of Baird and Girard, 1853. Fitzinger, 1843, applied the name *Thamnophis* to the species *T. saurita* of Linné. The habits of the species make the name (from *θάμνος*, copse, thicket, or bush) a most appropriate one.

THAMNOPHIS PROXIMA Say ; Garm.

Ventrals ranging from 167 to 175, and subcaudals from 107 to 108. In one case there are eleven infralabials instead of ten.

STORERIA DEKAYI Holbr. ; B. & G.

Two anteorbitals on one side of one specimen. Ventrals ranging from 135 to 138, and subcaudals from 51 to 53. The dorsal band varies from distinct to indistinct, and a series of small black dots at each side of the belly is present or absent. Apparently there is an increase in the number of scutes to the southward.

POTAMOPHIS INORNATUS Garm.

The types from which this species was described were secured near Dallas. Their principal difference from *Potamophis striatula* appears in the divided internasal, lack of an occipital ashy band, and in a stouter form.

Two specimens of this lot agree in the main with the types but have a single internasal and a larger number of scutes. For the present they are placed here to wait a larger series from which to determine the value of the differences. Each has 17 rows, 5 labials, 1 anteorbital, 1 postorbital, 1 internasal, and divided anal and subcaudals. One has 6 infralabials, 139 ventral, and 38 subcaudal scutes; the other has 6 infralabials on one side,

but 5 on the other, 139 ventrals, and 37 subcaudals. The length of a female, apparently adult, is $8.5 + 1.6$ inches.

A name meaning river snake, *Potamophis*, given by Fitzinger in 1843 to Linné's *Coluber striatulus*, is certainly not a very appropriate name for this genus. The next in order of publication would be *Haldea* of Baird and Girard, the only advantage of which would seem to be in that it has no meaning at all. If both of these names were dropped, the more applicable name, *Conocephalus*, given by Duméril in 1854, would be the next available.

HETERODON COGNATUS B. & G.

In each case there are 25 dorsal rows and, with one exception of 10, 11 scales in the orbital chain. Two specimens have 8 labials and 11 infralabials on each side; a third and a fourth have 8 labials on one side and 9 on the other; the third has 10 infralabials on one side to 11 on the other, while the fourth has 11 on each side. Anal and subcaudals all bifid. Scutes $139 + 44$, $131 + 49$, $137 + 43$, and $134 + 39$. The blotches in the dorsal series number $25 + 7$, $25 + 9$, $24 + 9$, and $23 + 8$. Form and coloration serve to distinguish this snake readily from *H. platyrhinus*. The light color beneath the neck and the tail makes it appear as if both neck and tail were carried off the ground.

LAMPROPELTIS DOLIATUS Linn. ; Cope.

Rows 21 in each case, scutes $201 + 49$, and $201 + 47$, 24 red bands on one, and 20 on the other. Labials 7 on the first, 7-8 on the second; infralabials 9. This and the two following species represent *Ophibolus* of Baird and Girard.

LAMPROPELTIS RHOMBOMACULATUS Holbr. ; Cope.

Rows 25, scutes $208 + 52$, and $207 + 51$. Dark

blotches on the back to the base of the tail; 59 on one, 56 on the other. Labials 7; infralabials 10, one has but 9 on one side. Scale pores two.

LAMPROPELTIS SAYI Holbr. ; Cope.

Rows 21, scutes 213 + 49, 222 + 51 and 205 + 47, labials 7, infralabials 9, in a single case 10. Each scale bears a yellow spot, yet the arrangement is such that it is possible in cases to count the blotches, which are found to be about 75 + 22.

DIADOPHIS DOCILIS B. & G.

A female with eggs; length $13\frac{1}{2}$ + $2\frac{1}{4}$ inches. Scutes 177 + 39, labials 7, infralabials 8. Lower surface profusely and irregularly spotted with black. Neck band orange. Posteriorly a black blotch reaches out from the flank, on the end of each scute, more than one-third of the way across.

COLUBER FLAVIVENTRIS Say.

Labials 7-8, infralabials 8-9, scutes 168 + 78, 162 + 79, and 170 + 74; lengths 24 + 7.5, 23 + 8, and 13 + 3.75 inches. The youngest is thickly sprinkled with small spots of dark color and has about 80 transverse blotches on the body, to the tail.

Commonly there appears to be but a single pore to each scale; frequently there are two, and near the base of the tail some have three. By Baird and Girard this species was placed in *Bascanium*.

COLUBER TESTACEUS Say.

Labials 8-7, infralabials 10-11, scutes 187 + 94, 191 + 107, 194 + ?, and 192 + 99. Pores normally two, frequently but one, occasionally absent, sometimes three or four on a scale near the base of the tail. To the rule

calling for lighter color under the neck these snakes are exceptions; they are darker anteriorly and spotted under the neck. The lighter color of the entire hinder portion of the body apparently indicates that the species is in the habit of lying in cover with but half of the length exposed. This is *Masticophis flavigularis* of Baird and Girard.

CYCLOPHIS VERNALIS (De K.) Harl. ; Gthr.

Labials 7, infralabials 7-8, scutes 143 + 71, and 139 + 85.

PHILOPHYLLOPHIS MAJALIS B. & G. ; Garm.

Labials 7, infralabials 8-7, scutes 166 + 117, and 164 + 115. This form seems to have a greater number of scutes under the body and a smaller number under the tail than *P. æstivus*. On the latter the body has about 155, and the tail about 130.

The genus *Philophyllophis* was founded for *Coluber æstivus* of Linné. That species was placed in *Opheodrys* by Fitzinger, 1843, followed by Cope. Gunther, 1858, placed it in his *Cyclophis* the type of which is *C. vernalis*, a form we can hardly regard as congeneric. The word *Opheodrys* is a play upon the roots of *Dryophis* of Boie, 1827.

PANTHEROPHIS LINDHEIMERII B. & G. ; Garm.

According to the original description of this species it differed from *P. alleghaniensis* in having twenty-nine rows of scales and a lighter coloration. The five specimens at hand agree with these statements in regard to colors, but differ in having only twenty-seven rows, thus agreeing in this respect with the species from the northeastern states. The differences between *P. alleghaniensis* and *P. Lindheimerii* parallel those existing between the *Colubers*, *C. constrictor* and *C. flaviventris*. Instead of the glossy black

obtaining in the eastern form the Texan has a brownish color in which the dorsal blotches are persistent. The spots vary from light brown to dark, but are in no case black, and the ventral surfaces are more yellow than brown. The white-edged scales of the back are present in all, and the blotches of the larger ones show no indication of becoming obsolete. On the flanks there is a reddish tint. There are 29 to 33 dorsal blotches, to the base of the tail. The tail is more uniform in color, and darker on the larger specimens.

Rows 27, labials 8, infralabials 13, in one case 12, 1 anteorbital, postorbitals 2, on one individual 3 on each side, scutes 236 + 87, 230 + 85, 229 + 84, 226 + 81, 229 + 83. One individual has a half-scale in front of the left half of the anal.

This genus is *Scotophis* of Baird and Girard, 1853; it was indicated by Fitzinger, 1843, under the name *Pantherophis* having as the type species *Coluber guttatus* of Linné.

Mus. Comp. Zool., Cambridge, Mass., Dec., 1891.

NOTICE TO A SOLDIER.

Salem, Sept. 30, 1777.

TO MR. DAVID MASURY,

Sir:

In pursuance of orders from the commanding officers of this regiment I hereby detach you to serve as a soldier agreeable to a resolve of the General Court of the 26th instant, being thus detached you are hereby ordered to appear in School Street to-morrow at 3 o'clock in the afternoon with a good firelock, accoutrements and blanket, there to join the company and receive further orders from Capt. Benjamin Ward. Hereof fail not as you would avoid the penalty of the Law.

JOSEPH SPRAGUE, *Major.*

SLAVERY IN MASSACHUSETTS.

The Boston and Salem newspapers a few years before the Revolution, contain many advertisements of slaves to be sold, and in some instances to be given away. In the latter case it was probably where such help could not be made profitable to the owners for some reason or other; perhaps the holders had no employment, or perhaps the slaves were too young or inefficient. Whatever the reason might be, bills of sale occasionally turn up where even

children commanded a good price. Among the Essex Institute MSS. we find the following Bill of Sale, which may be of some interest.

Cambridge, June 22, 1761.

Mr. Peleg Sterns bot }
of Henry Price }

A negro boy named Jack about six years and ten months old. Helthy and Sound for the Sum of thirty Six pound thirteen Shillings and four pence Lawfull Mony—£36 : 13 : 4—which Negro I have a Just Right to Sell as witt^s My hand.

Henry Price

Errors Excepted
pr Henry Price.

Witt^s

Rachel ^{her} X Swinnerton.
_{mark}

Beniamin Jennings.

REVOLUTIONARY LETTER.

"Camp at Providence June 28th 1777.

I congratulate you my dear Sir on the recovery of your family from the Small Pox (which by the bye I am not obliged to Major Sprague for the Knowledge of).

The Gent^l by whom I shall send this sets off this morning for Boston, (as Col. Titcomb did the day before yesterday) to know what the court will do concerning a new supply of Troops to take place of those now here, whose time of service is just expiring. I have not time to be lengthy (thats well says you) as the gent^l. only waits to take a letter from the Gen^l. relative to a piece of intelligence bro't by Mr. Commissary Waterman of this department who arrived here last night from New London and

brings acct that one Bulkly a man of character belonging to Connecticut came off from one of the British ships where he was a prisoner who says that last Sunday a smart engagement happened between the Rear of Hows army on their retreat & the front of Gen^l. Washingtons, that Hows army had all retreated to Statten Island & that the Transports were ordered round to take the troops on board, that he the said Bulkly himself saw 3 flat bottomed boats with Dead & wounded landed on the Island, that the officers on board were uncertzain where they designed for, their conjecture being various, some supposed Connecticut, some Rhode Island, this acct. is from the Gen^{ls} own mouth. Major Hovey, the Bearer of this to Boston waites, or I would be more particular—hurry must excuse inaccuracies. I yesterday saw a Halifax paper of the 25th May in which were a number of abominables amongst which was the case of Seaton which I wish you would call on Mrs. Hiller and see.

I am

Saturday morn,
Major Sprague.

Sir yours unalterably
J. Hiller."

This is addressed to

Major Jos. Sprague Esq.
Salem.

7. 28
JUL 1892

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THE WA-WAC-KA-TCI-NA, A TUSAYAN FOOT RACE.

BY J. WALTER FEWKES.

AMONG the customs of the Indians of Tusayan,¹ there are none more suggestive from an ethnological standpoint than the games and races of these people. In many of the great nine days religious festivals, as the Snake Ceremony, the Flute, and the *Lā'-lā-kon-ti*, races up the mesa trails are introduced on the morning of the ninth day. These races, which I have already described,² have many resemblances to each other as pointed out elsewhere, and are necessary parts of the ceremonials, which make up some of the more important religious celebrations.

¹The following observations were made while connected with the Hemenway Expedition in the summer of 1891. By the Indians of Tusayan I mean the acolents of the northeastern part of Arizona, or those commonly called the "Mokis."

²Descriptions of the ceremonial rites mentioned above will be found in the *Journal of American Ethnology*, and *The American Anthropologist*. (For Flute Ceremony, *Journ. Am. Eth. and Arch.* Vol. II, No. 1; *Lā'-lā-kon-ti*, *Am. Anthropologist*, April, 1892.)

The Tusayan or Moki Indians at present live in seven villages of which O-rái-bi is the most populous, the most distant from the railroad and therefore least modified. These village Indians have built their pueblos for security against foes upon lofty mesas approached by steep trails. The East Mesa or First Mesa is the site of three villages called Wál-pi, Si-teúm-o-vi, and Hã'-no or Tē-wa. Of these three Wál-pi is the most populous and Si-teúm-o-vi the smallest. They are situated on the flat platform which forms the top of the mesa, in a space not more than a half mile in length and a few hundred yards broad. The three towns are but a short distance from each other. Wál-pi, in some places four stories high, lies at the very west end of this mesa. The pueblo is compactly arranged with no outlying houses, although a few of the families have built houses in the plain below.

Si-teúm-o-vi is a rambling pueblo in different quarters one and two stories high, enclosing a central plaza. Tē-wa or Hã'-no has, at the east end, a group of houses four stories high built around a projection of rock on the mesa top, and the quarter facing the south has two stories.

The second mesa is split into two parts upon one of which stands the village of Mi-cóñ-ín-o-vi; on the other Ci-mó-pa-vi. Ci-páu-lo-vi, which also rises from the same mesa like a Saracen's castle, crowns the top of the conical elevation and is the most picturesque of the seven towns of the Tusayan. These three towns of the Middle or Second Mesa are placed at the angles of an irregular triangle, Ci-mó-pa-vi being separated from the part of the mesa on which the other two towns are situated by a deep valley entering from the southwest. The most distant of the seven pueblos from the railroad is O-rái-bi lying some fifteen miles beyond the Middle Mesa. This village is likewise perched on a table-land to the top of which the trails are very steep.

Wal-pi takes its name from its vicinity to a gap in the mesa, Té-wa from the racial affinities of the inhabitants, Mi-cóñ-in-o-vi from the two pinnacles which rise from the foot hills, and Ci-páu-lo-vi from the adjoining peach orchards. All the villages with the exception of Té-wa,¹ speak the same language, and although there are variations in certain of their manners and customs, they are in the main similar. The towns of the East Mesa are the best known, and O-rái-bi from its present (1891) hostile attitude is practically unexplored ground.

The foot race described in the present article is called the *Wā-wāc-kā-tci-nā*, and has twice been witnessed by the author. These races were so different from those which

¹ I have already elsewhere called attention to the fact that there is a difference linguistically and otherwise between Té-wa and the other two towns on the East Mesa. The history of the ancestors of these Té-wans who settled among the Hopi, as far as their departure from their old home is concerned, is partially known, and at least the approximate time when they came into the country has been recorded. The problem concerning the mutual relations of the villages which especially concerns the ethnologist is an investigation of the mutual changes which have come to both peoples by the association in their isolated homes. Preserving as they do their own language it is but natural to suspect that they brought and kept alive many of their old customs. We know that the women at the present day for instance, dress differently from those of the Hopi women and there is more or less variation in many of their customs.

Of the ceremonials which the Te-wans have imported may possibly be mentioned the *Mu-cai zru*, or bison dance. An exhaustive comparison of the modification in their language with that of the Eastern Te-wans is yet to be made, and there is also a great field open for a study of their equivalents of the Hopi divinities. When that is accomplished we shall be in a fair way to take steps in the identification of Hopi divinities, with those of the more eastern pueblos. I have already made a beginning in this study but have not yet progressed far enough to make known my conclusions.

In a broader way we have still a more general problem presented by the pueblo life of Tusayan. It has long been claimed and generally accepted that these people are related to the Shoshonees. As to the justice of that relationship I do not know enough to express any opinion, but if the linguistic relationship is near, it is an important problem to trace out the relationship between their customs and those of the nomadic tribes of the same stock, and it becomes an interesting study to determine the amount of influence resulting from their adoption of the village habits. The field for research which here opens is of a most general character and of greatest importance. Of the relationships with the Nahuatl, I shall speak in a future publication, for I am not yet prepared to say that the relationship is close, although there are several significant resemblances in ceremonials which call for more facts for solution.

take place at the time of the great ceremonials as the Snake, *Lū'-lū-kon-ti*, and Flute, that they merit a special description. Moreover as several *Kā-tci-nās*,¹ which I have not seen in any other celebration, take part in these, and as the name given it at least implies a mythological relationship, it seems appropriate as a contribution to our knowledge of the mythology of these Indians to devote a special article to a description of it.

The following pages contain an account of the main events in the *Wā-wāc-kā-tci-nā* with a description of some of the participants. The author finds it necessary as a first step in the interpretation of the complicated mythology of the Tusayan Indians to preface with similar simple descriptions an article which he has in preparation in the distant future, explanatory of all the important ceremonies.

This account of the *Kā-tci-nā* foot races therefore, which is one of a series,² must be used in a comparative way with others already published or to follow. He is not prepared, before more data have been collected to offer a satisfactory explanation of the various events which are described.

The first *Wā-wāc-kā-tci-nā* which was observed took place in Ha-no (Te-wa) on May 11th; the second in Si-

¹The term *Kā-tci-nā* is applied to a great number of mythologic and semi-mythologic personages although more strictly confined to certain masked dances which appear in the public celebration of many ceremonials. The different kinds of *Kā-tci-nās* are very numerous and their relations to each other in the Hopi Pantheon very complex. The majority of the *Kā-tci-nās* bear names of animals, as *Kwēy-wē* (wolf), *Kō-hó-ne* (chipmunk), *Ka-vū-ho* Spanish (horse), *Ho-nān-i*, (bear), but names of deities as *Dā'-wū* (sun), *O-mow-ūh* (clouds), and others, may also have the same designation. This complicated subject will be discussed later, and it is only necessary here to call attention to the fact that certain public dances like the participants are called *Kā-tci-nās*, from the presence of personifications of these beings. A modified term sometimes written "*Cā-chi-nū*" is widespread among the New Mexican pueblos, and is sometimes applied to a sacred dance among certain tribes.

²See *Journal of American Ethnology and Archeology*, *American Folklore Journal* and *American Anthropologist*.

teúm-o-vi on May 17th. Although different *Kā-tci-nās* appeared, the events of the race in both are the same. The *Wā-wāc-kā-tci-nā* is more after the nature of a secular than a religious observance; although from its name and the personages who take part, we may regard it as connected with ceremonial observances.

The *Wā-wāc-kā-tci-nā* is a race in which the *Pai-ā-kya-múh*,¹ *Tā-tcúk-tí* and certain *Kā-tci-nās* challenge the fleet-footed inhabitants of the pueblos to run for prizes. The winnings were always taken by the civilians, but if caught by the *Kā-tci-nā*, he pays the penalty by light or severe strokes of the yucca whips carried for that purpose by the opponents.

The two *Wā-wāc-kā-tci-nās* occurred within five days of each other, just before the first *Hu-mis-kā-tci-nā*, a sacred dance which was celebrated in several of the villages.

The first celebration of the *Wā-wāc-kā-tci-nā* was at Tewa and the participants prepared themselves in the recess of the cliff on the main trail about fifty feet below the edge of the mesa. They marched up to the plaza about sunset, bearing the prizes done up in blankets on their backs.

There were ten *Pai-ā-kya-múh* (gluttons), and six *Kā-tci-nās*. The former wore on their heads long horns ornamented with corn husks, and girt with black stripes. Similar black stripes were painted on their body, face and

¹The reader will find a discussion of the different "priesthood fraternities" in the Tusayan villages, in my article on "Summer Ceremonials," *Journal of American Ethnology and Archaeology*, Vol. II, No. 1. The *Pai-ā-kya-múh* are clown gluttons who made fun during some of the sacred dances, and were from Te-wa. They belong to the priesthood called *Tcu ku-wymp-ki-ya*, one of whom carries in his belt a *Tcu-ku-mū-nā*, or stuffed water-wren. The *Tā-tcúk-tí* are also *Tcu-ku-wy'mp-ki-ya* but they wear cloth noseless helmets with knobs or sausage like appendages, great goggle eyes and protuberant mouth. Still another kind of *Tcu-ku-wy'mp-ki-ya*s, not represented in the *Wā-wāc* which I have here described, has yellow painted faces with black bars as elsewhere described.

arms. All were loaded down with great bundles of *pi-ki*,¹ bundles of corn and other eatables which had previously been brought to the dressing place or recess in the rocks, by the women. The *Kā-tci-nās* laid these bundles of food on blankets placed on the ground at the north end of the plaza, and stood in line facing the west as if challenging the spectators to race. After the *Kā-tci-nās* and *Pai-ā-kyā-māh* had deposited their prizes on the blanket, an old priest shouted to the spectators. One after another, young men accepted the invitation to race by walking to a position in front of the line of *Kā-tci-nās*, and at a signal raced across the plaza at the top of his speed pursued by a *Pai-ā-kyā-māh* or a *Kā-tci-na*. Only one pair, however, raced at a time, but, if the *Kā-tci-nās* overtook his opponent he struck him once across the body or legs with a yucca leaf which he held folded up in the right hand, tore his shirt from the body of his opponent, or cut off a lock of his hair.

The prizes were distributed to those who entered the lists by an old priest who directed the race. In one or two instances the *Kā-tci-nā* was able to overtake the runner entering against him; in several, however, he was distanced, but in all cases whether overtaken or not the contestant received a prize. At the close of the race the yucca-wands

¹*Pi-ki* or paper bread is the national food, if that expression may be allowed, of all the pueblo people. This is a kind of corn bread which is fried on a flat stone under which fire is burning. The batter is spread upon the greased stone by the hand and as the *pi-ki* is fried, the thin wafer-like sheet is raised from the stone and deposited in a heap. It is then either folded in squares or rolled in bundles for consumption. The common kind is the color of the most of the wood work, but bright red striped and other colored *pi-ki* are made. Several rolls of variegated *pi-ki* tied together side by side are not uncommon sights hanging to the walls in dwelling rooms. At the time of the foot races here described there was a considerable quantity of red (stained with cockscomb flower) *pi-ki* among the prizes. On occasions of ceremonies variegated *pi-ki* is common, but the favorite dish at that time is a pudding or *pi kum-i*.

were taken from the hands of the participants by the priest who sprinkled meal on the *Kā-tci-nās* and *Tā-tcūk-ti*, and deposited the yucca wands in a *bā-hó-ki*¹ near the pueblo.

A second celebration of the *Wā-wāc-kā-tci-nā* took place on the eve of the *Hu-mis-kā-tci-nā*, four days after, at the village of *Sī-teúm-o-vi*². This celebration closely resembled the first, but different personages were introduced. The *Tā-tcūk-ti* and *Kā-tci-nās* dressed themselves in the recess of the cliff under the *bā-hó-ki* between *Wal-pi* and *Sī-teúm-o-vi*. The race took place in the plaza of *Sī-teúm-o-vi*, the *Tā-tcūk-ti* standing at the east end near the row of houses at that place. *Tā-tcūk-ti* and *Kā-tci-nās* took part, but no *Pai-ā-kyu-máh* appeared as in the celebration at *Té-wa*.

The following personages were noted in the two races which were studied in the summer of 1891 at the East Mesa.

HU-HU-WUH.

Hü'-hü-wüh appeared in the *Wā-wāc-kā-tci-nā* at *Té-wa*. I have studied the mask (Pl. II, fig. 4) worn by him and also have in my collection a figurine (doll) of the same personage. From these and a photograph (Pl. I, fig. 1) taken during the performance, a good idea of his symbolism can be readily made out. The head of *Hü'-hü-wüh* was

¹A *bā-hó-ki* is a shrine in which feathered sticks called *bā'-hos* are deposited and around which certain ceremonials are performed by novices and others on certain occasions. Their form varies somewhat but they are ordinarily simple square or rectangular cairns of stone, often uncovered, in which often a curious waterworn botryoidal stone is placed. Simple heaps of stones dedicated to *Mā'-sau wüh* may often be termed *bā-hó-ki*, and small cavities in boulders have the same designation. The *bā-hó-ki* in which certain offerings, as those of the "Farewell *Kā-tci-nā*", are placed is a covered chamber and the flat slab over it may be luted in place after use with adobe.

²On the afternoon before the race the plaza was carefully swept in preparation. The celebration took place at a little before sundown before a large assemblage of spectators. Many of the racers, possibly all, were from the neighboring village of *Wal-pi*.

covered by a helmet, made of leather, and painted brick red. The hair of the helmet was a white skin. A prominent nose was represented and the eyebrows were outlined in a way very different from the same in sacred dance masks. The distinguishing marks of the helmet were two white lines, one on each side, extending from the nose across the cheeks broadening as they reached the edges of the mask.

The photograph of the man taking the part of *Hü-hü-wäh* shows that he wore a ceremonial dance kilt and that the rest of his body was naked, with the exception of a fur about his neck and a scanty kilt. The body was, however, painted and decorated with parallel finger marks irregularly drawn over it. In the *Wā-wāc-Kā-tci-nā*, *Hü-hü-wäh* is lame, and in the doll the legs are represented as crossed. He hobbled about during the race creating much fun and boisterous laughter by the spectators.

KE-SE-KA-TCI-NA.

Ke-se-kā-tci-nā, the hawk *kā-tci-nā*, also took part in the *Wā-wāc-kā-tci-nā* of May 16th. The material at my disposal for a study of his symbolism and dress are two Kodak photographs (Pl. 1, fig. 4) and notes made during the race. In the photograph, which is introduced in Plate 1, it is seen that his helmet is covered with downy substance, probably white feathers, and the snout is protuberant. Around his neck there was a coarse cloth. His body was painted white and upon each upper arm he had a string of primary feathers in imitation of wings.

In the *Wā-wāc-kā-tci-nā*, *Ke-se-Kā-tci-nā* ran about from place to place with body crouched forward imitating the hawk, moving his arms as if they were wings.

Among the personages who took part in the racing *Kā-tci-nā* at Ci-páu-o-vi, there was one of whom I did not get a

photograph but who was identified as the *Mung-wa* or Owl *Kā-tci-nā*. He wore a helmet not unlike that of the owl which I have seen in the *So-yó-him*¹, but I am doubtful whether it was really intended that he should represent this *Kā-tci-nā* or not.

There was still a second which I was also unable to identify. From the variations which occur in the race as performed in the different villages, it seems legitimate to conclude that the running *Kā-tci-nā* varies very greatly in different pueblos. It would be most interesting in a comparative way to study the *Wā-wāc-Kā-tci-nā* at O-rái-bi where it occurs, as I am informed by one of the Indians, and in which judging from their celebrations, would probably be of more primitive character.

There are several pictographs² which have been identified for me as pictures of the *Wā-wāc-Kā-tci-nā* which would seem to enlarge a number of mythological beings who take part in these races. The present article is therefore after the nature of a preliminary sketch to be supplemented later by a more extended account with explanations.

UTE-CE-E-KA-TCI-NA.

Ute-cē-ē or Apache *Kā-tci-nā* appeared in the *Wā'-wāc* with *Kē-se-kā-tci-nā* (May 16th). I have as material for the study of this character several photographs (Pl. I, fig. 2) taken in the *Hu-mis* dance and in the *Wā'-wāc* at Si-tcúm-o-vi, and have also examined the masks (Pl. II, figs. 2, 3, 4) which were in each ceremony.

The mask (Pl. II, fig. 1) is made of leather barely large enough to cover the face and is bent into shape to

¹The *So-yó-him-Kā-tci-nā* dance, described in Vol. II, *Journal of American Ethnology and Archaeology*, was witnessed in Ci-páu-lo-vi. In this ceremony many different *Kā-tci-nās* of many colors participated.

²See *American Anthropologist*, January, 1892.

cover the face. The nose with nostrils is represented in relief¹ and the lips are protuberant. The eyes are simple round holes, without ornaments or marks to represent eyebrows.

The mask is painted white with vertical parallel red lines extending the whole length of the face and along the middle line of the nose. The hair is stiff black horse hair which is tied to the upper rim of the mask and stands upright. The ornamentation of the face of a *Ute-cē-ē* mask (Pl. II, fig. 3), used in the *Hu-mis-Kā-tci-nā*, which I have examined, is somewhat different from that already described.

Like the above mentioned it is painted brick red, the nose and eyebrows being formed of pieces of leather of the same color affixed to it. Across the face on a level with the eyes is drawn a black band and radiating black marks are painted above the eye openings. A similar parallel black band and radiating black marks are painted above the eye openings. A similar parallel black band is painted from each corner of the mouth to the edge of the mask. Across the middle of the face and over the nose is painted a zigzag white band, with five parallel zigzag white bands on the chin.

The photographs (Pl. I, fig. 2) of *Ute-cē-ē-Kā-tci-nā* show that his body, arms, and legs are crossed by parallel lines made by drawing the fingers smeared with color over the skin. The photographs of *Ute-cē-ē-Kā-tci-nā* in the *Wā-wāc-kā-tci-nā* show that he wore a tight-fitting cap without a wig while in the *Hu-mis*, the same *Kā-tci-nā* has the long black horse hair unconfined.

Another mask (Pl. II, fig. 3) of the Apache *Kā-tci-nā* was much more complicated than either of those which we have described, but like the former, the face was painted

¹The nose of the pot helmets used in *Kā-tci-nā* dances is rarely if ever represented.

brick red. The mask was made of leather and crossed by two parallel zigzag lines in white over the nose and by two similar zigzag lines not parallel upon the eyebrows. A black mark extended from the corners of the mouth to the edge of the jaws, and a similar black line from the eyes to the ears parallel with the first. On the upper part of the head there was a dentated crown in white upon a black ground, and on the back of the helmet there were symbolic crosses representing the star god *Co-tū'k-i-nung* and two serpents. This helmet was much more complicated than the other two which we have described and is a much more elaborate piece of work. Portions of the back of the helmets were made of an old felt hat, but the mask was of leather.

HO-NAN-KA-TCI-NA.

Among the participants is the *Wā-wāc* at Te-wa was a man dressed in a rabbit robe, who wore on his head a rounded helmet with protuberant snout. He carried in his hand a stick at the end of which was tied a branch of cactus, with which he went from one to another of the spectators paying his attention especially to the women, girls and boys, driving them from their seats in the plaza with this spiny implement. This *Kā-tci-nā* was decorated with the symbol of the bear *Hó-nan-i*, a figure representing the imprint of the bear's claw and on that account has been identified as the Bear *Kā-tci-nā*.

CHE-KA-NA.

During the *Wā-wac* at Si-teúm-o-vi, two persons wearing the helmet of *Che-kā-nā* took part. I have examined the helmets worn by them but did not succeed in getting good photographs. The helmets are painted brown on one side of the face and green on the other, the eye openings having rows of dots above them. From my notes I find that the bodies of these persons were painted in two colors.

A single personage wearing the *Ley'-to-to-bē?* mask also appeared in the same *Wā-wāc*. The helmet was painted black with a red band across the eyes. A boy called *Tā-cā'-bē*, Navajo, wearing a mask not unlike that of *Ute-cē-ē* appeared in the same *Wā'-wāc*, but he took a very subordinate part in the race.

TA-TCUK-TI.¹

The largest number of participants in the *Wā-wāc-kā-tci-nā* at Si-tcūm-o-vi were the *Tā-tcūk-ti*² or knobbed-headed priests who play an important part as clowns in the Tusa-yan sacred dances. The *Tā-tcūk-ti* were naked with the exception of a simple cloth about their loins and the helmet coverings of their heads. Appended to the sides of the close-fitting cloth helmets there were several knobs filled with seeds, or long sausage-like appendages hanging down the cheeks from either side.

The bodies of the knobbed-headed priests were marked with lines drawn by the fingers on the mud with which they are smeared and their feet are without moccasins. *Tā-tcūk-ti* ordinarily stood (Pl. I, fig. 3) in line back of the piles of prizes spread out on the blanket on the ground and armed with a yucca leaf. While awaiting the beginning of the race this leaf is closely folded in the hand and it is only when they have overtaken their contestants that this whip is unfolded and used in striking the legs and back of the luckless individuals whom they overtake in the race.

PAI-A-KYA-MUH.

These personages have already been described and figured elsewhere.³ They wear a closely fitting skull cap upon

¹Sometimes the first syllable is reduplicated, *Tā-tā-tcūk-ti*.

²From *Tā-tci*, a knob, referring to the knobbed helmets which they wear, or from a verb meaning to leap up or jump.

³*Journal of Am. Ethnology and Archaeology*, Vol. II, No. 1.

which are two horns girt with alternate white and black bands, and bearing a few corn husks at the top and base. The cap is likewise girt with black and white bands and both of the same colors are painted on their bodies, arms and legs.

They are Tewan members of the *Tcu-kú-wy'mp-ki-ya* and from their actions in dances may very properly be called gluttons. The same personages have been photographed by me in Wál-pi sacred dances, and I have a doll of a *Pai-ā-kyá-múh* which has most of the symbolic marks mentioned above. As *Tcu-ku-wy'mp-ki-ya* to which group of priests the *Tā-tcúk-ti* likewise belong, these men very properly figure in the *Wa-wac-kā-tci-nā*.

Among the many masks and helmets which one sees by searching in the hidden rooms of the villages I have found several which have been referred to the *Wā-wác-kā-tci-nā*, and I suspect that from time to time other characters besides those described also take part in the races which have been described. One of the most characteristic of these masks is said to be that of *Hém-i-cow*. The helmet of *Hém-i-cow* which I observed in the *Al-kib-va*¹ at Wál-pi is unlike any other with which I am familiar. It is of cylindrical shape and painted black with green, yellow,

¹ The so-called kib-vas are subterranean chambers built in crevices in the rocks and are used in the performance of the secret portions of religious ceremonials. Of these there are five at *Wál-pi*, two in *Si-tcúm-o-vi*, and two in Tewa. The *Al-kib-va* is one of the smallest of these and is situated on the dance plaza at Wál-pi. It is, however, one of the important kib-vas and in it are performed the ceremonies of the *Mám-zrau-ti* (a woman dance in September, see *Amer. Anthropologist*, July, 1892.)

The kib-vas are ordinarily used as gathering places for the men and in them many blankets are woven. Although it is not customary for the Indians not engaged in any ceremony, to enter the kib-vas, we were always permitted free entrance, with one or two exceptions. I have given elsewhere an account of the more important architectural details of the kib-vas and their orientation, and the *Al-kib-va* is not in any respects characteristic. The *Al-kib-va* is the kib-va of the Horn men or Horn priests, and in the *Nā-á-c-ná-yū* it is the place of the ceremonies of the warrior fraternities.

red, and white bands around the upper rim. From these bands depend other lines or bands painted in the same colors, a medial band being red and those on either side yellow, white and green. Above the round orifices marking the position of the eyes there was tied a small fragment of pith, the signification of which is unknown to me. The mouth is duck-bill shaped not unlike that so common among the *Kā-tci-nās*.

In order to show how the race which has been described differs from the ordinary running races which accompany the great celebrations in the Hopi calendar, let us take for illustration that performed on the morning of the ninth day in the *Lā'-lā-kon-ti*.¹ This race differs in details from that of the Flute, the Snake and the *Nimán-kā-tci-nā*, but has several points in common with them; so that, looking at their relationship in a broad way, we may say that their common features show the general character of the races which accompany the great ceremonials.

The races in the festival mentioned always take place from the plain or the foot hills up the mesa trails, although the limits of the race are two points in the plain or in the foot hills. The termination of the race is not limited nor do the contestants stop running until they enter the village on the top of the mesa. In certain of these the final ceremony connected with the race takes place in the underground *kib-va* where the rites of the particular festival are celebrated.

The man who stands at the terminal goal of the race is a priest dressed in appropriate costume holding a crooked stick in his hand. He makes upon the trail, near which he stands, in sacred meal, the symbol of the rain cloud. As the racers approach they pass over these figures and

¹ For description of the *Lā' lū-kon-ti* see *American Anthropologist*, April, 1892.

touch the crook which he holds, with the palm of their hands. In the case of the *Lā'-lā-kon-ti* in which a girl races with the men, this girl is placed within a circle of meal upon the trail and near her is deposited prayer sticks called *bā'-hos*. The crook which the priest holds is deposited after the race in a shrine and sometimes brought to the *kib-va*. In the *Lā'-lā-kon-ti* the former deposition is made, and in the Snake and Flute races the latter, but in all instances the contestants are compelled to run up the hillside before the race is finished.

In none of the races up the trail which I have witnessed did the clowns or *Kā-tci-nās* take part. It will be seen from my account¹ of these races that there is no close relationship between them and the *Wā-wāc-kā-tci-nā*. The winners are not given prizes nor do the participants flog each other with yucca wands. Of all the foot races which I have seen the *Wā-wāc-kā-tci-nā* is unique in its character. I have not referred to the meaning of the *Wā-wāc-kā-tci-nā*, although from its character and the participants who take part, there can be no doubt but that it reaches back to the early history of the people.

One is tempted to regard the *Wā-wāc* as the same as the spring races which have been described in the Rio Grande pueblo, but the exact relationship is not wholly clear to me. The presence of the *Kā-tci-nā* is an important element which will be spoken of in a later publication in which comparative accounts of the two will be considered.

It is said that the prize in the Snake race is the greatest of all prizes attainable, namely, long life and all the blessings which come to men, but however this may be, the

¹ *Journal of American Ethnology and Archaeology*, Vol. II, p. 1.

winner of the Snake race is a marked person. The so-called Snake race which occurs on the morning of the ninth day of the Snake Antelope ceremony before dawn is traditional and like so many other ceremonial customs is said to date back to the infancy of the people. Bourke in his work on the Snake dance has called attention to ancient races in Mexico up the Teocalli or pyramids and the fact that the runners in a Snake race do not stop before they arrive at the top of the mesa. The thought is a suggestive one and will be considered elsewhere.

The *Wā-wāc-kā-tci-nā* also occurs in certain proceedings which take place on the afternoon of several of the *Kā-tci-nā* dances. I have already elsewhere described the antics of the *Tā-tcūk-ti* and certain *Kā-tci-nās* while the sacred dances¹ are taking place. These personages endeavor in every way to amuse the spectators both in the intervals between the dances and while the latter are progressing. These antics consist of puns, inordinate eating, indignities to each other and curious or grotesque situations in which they are placed. I have recounted some of these in my notice of the summer ceremonials and have likewise witnessed the *Wā-wāc-Kā-tci-nā* in sacred dances here performed by the *Tā-tcūk-ti* and others dressed as *Kā-tci-nās* who come in for that purpose. These *Kā-tci-nās* were different from those taking part in the sacred dance and were generally personified Apaches or Navajos or certain phallic societies. This fact is significant when taken in connection with that known from the descriptions above where the Apache personification is so little known. Although these Apache *Kā-tci-nās* are not the only ones who take part in the exercises we are

¹See *Hu-mis*, *Kā-tci-na*, *Mā-lo-Kā-tci'-nā*, etc. (Journ. Amer. Eth. & Arch., Vol. II)

about to describe, they were present in several characteristic performances which I have noticed. One of the most interesting of these is the dance of the *Tcu-kú-wymp-ki-ya*. While the dance of the *Kū-tci-nā* was taking place in the celebration of the *Humis-kā-tci-nā* a blanket were laid down near the west end of the line and upon this was placed bundles of corn, *Pi-ki* or paper bread, and food of all kinds. Behind this, facing it, the *Pai-ā-kyā-mūh* were seated in line and to each was given one of the bundles as a gift. The men personifying Apaches, of whom there were two, then caused one of these to rise and led him to the extreme east end of the line of dancers who were meanwhile singing and performing their dance. Each *Tcu-kú-wymp-ki-ya* was forced to dance and to tell a story in payment for his gift.

When the glutton had been carried to the east end of the line he was stopped, turned around and addressed or commanded by the Apaches who raised their horsewhips or "quirts" in a threatening manner. Moving a few steps in a sidelong manner, the gluttoned followed by the Apaches performed an archaic dance saying, "A-e, A-e." At a word from his tormentors he started again moving a few feet with an awkward, sidelong, halting gait and stopped again. As he did this, he again began his story, calling down laughter from the spectators. This was repeated again and again often urged forward by strokes from the whips of his tormentors until he reached the pile of corn in front of his comrades. A second member of the line, squatting back of the corn was then treated in the same way, and the same series of halts, shouts and jokes were repeated. All the gluttons were forced through this performance causing much merriment from the lookers-on. The whole effect was simply to amuse the people, and if it

is a modified dance it has certainly degenerated into a ludicrous performance.¹

I have witnessed the same or a similar thing at the village of Ci-pàu-o-vi during the dance of the *Mā-lo-kā-tci-nā*, the only difference being that instead of the *Pai-ā-kyamūh*, the *Tā-tcūk-ti* were the sufferers. There were at that village several persons taking part, who wore Navajo or Apache masks. They carried ancient leather shields ornamented with crosses and other figures of a symbolic significance. In the same celebration a person appeared wearing the Owl *Kā-tci-nā* mask. I have likewise seen *Má-sau-wūh*, the death god, personified in the *Wá-wac*, a hideous personage wearing about his loins for a belt the intestines of a dog recently killed, the face and body smeared with fresh blood.

One is tempted to regard these antics of the clowns and the Navajos and Apaches as burlesques of races introduced during the solemn dances, but if such is the explanation this portion of the dances is highly modified and come to be regarded as an opportunity to introduce local allusions and modifications which cannot be regarded in the same light as the dances themselves. Consequently, the events which occur at that time, in which the clowns participate, should not be regarded as necessarily related to the historic ceremonies.²

Much is left to individual invention of the clowns to render their part more striking and it is not rare to see

¹In most instances the stories told by the gluttons for the amusement of the spectators were obscene but not always so. On one occasion one of the younger gluttons when forced to tell a story recounted the improvements which the people were making in late years, a suggestive ray of light on the otherwise sombre background of primitive savagery.

²It has been suggested that the introduction, for instance, at this time, of a colored soldier is of ancient date, but it is undoubtedly not older than the employment of negro soldiers in the army of the United States.

them introduce personifications of events which occur during the summer. The existence of this curious modified performance, by which the Navajo force the gluttons to run and their refusal with many objections may, however, be of ancient origin.

The introduction of such personages as *Ute-cē-ē* (Apache) and *Tā-cāb-kā-tci-nā* by the Hopi in their sacred dances is an interesting fact. It must be borne in mind that the village Indians of Tusayan have had frequent wars with these tribes, often of most bloody character. I have been shown a cleft in the East Mesa near precipitous cliffs at the west end, where the dead, in one of their wars with the cruel Apaches, were buried, and I have been told of a certain struggle with them in which the hearts of the dead Apaches were given to the Hopi women (the unmarried women were especially mentioned) to eat, in order that their children, Hopi warriors, might be brave against their enemies. This story was told me on good authority and, in a comparative way, one has no reason to doubt its possibility.

Notwithstanding, however, this traditional hatred in the Hopi mind against the Apache and Navajo the villagers have introduced an Apache *Kā-tci-nā* in the *Wā-wāc-kā-tci-nā*, while in the *So-yó-him* a sacred *Kā-tci-nā* dance a personage called the *Tā-cāb* (Navajo) is prominent. This incorporation of foreign *Kā-tci-nās* is suggestive. We can readily see a good reason for the introduction of *Kā-tci-nās* from the Zuñis, but it might seem strange that others should be derived from enemies. The way the Hopi regard this question may, however, be summed up in a liberal statement expressed by An-a-wi-ta, viz. :—that it is wrong to speak of *Kā-tci-nās* as Zuñi or as Hopi. The *Kā-tci-nās* are without nationality, "they are for all," but

certain peoples preserve the cult of individual *Kā-tei-nās* better than others. In following the lead of those who best know any particular *Kā-tei-nā*, no element of hostility should play any part. It might readily be concluded that as far as the gods are concerned, the Indian is prepared to be taught by any one who has valuable knowledge of the *Kā-tei-nās*. I do not affirm that the Hopi so regard this question or that this is their reason for the introduction of strange *Kā-tei-nās*, but I so interpret the few remarks which I have heard on this point.

Tā-cāb-kā-tei-nā ordinarily wears a helmet with a band across his face not unlike that of *Hū-hū-wūh*. On the dolls of *Tā-cāb-kā-tei-nā* which I have, some specimens have the same marks painted in different colors but in several they are absent altogether. I shall discuss this question more at length in my article on Hopi figurines (dolls).

In interpretations of the meaning of Hopi ceremonies, personages and paraphernalia which appear in the same, a strict line of demarcation must be drawn between possible and real explanations. The nature of the subject is such as to invite one to speculation. The explanation built on the testimony of priests is good as far as it goes but even this is not always final. Human nature is fallible and while a priest may report the explanation which he has heard from his antecedent in office, the element of invention and mistake in transmission from generation to generation must always be taken into account in a final estimation of the subject. Although the explanations advanced by the priest to explain ceremonies and personages which occur in such is capable of scientific treatment, they cannot be regarded as exact knowledge or science, but must be used for what they are worth. That the priests believe that the crooks about the altar and the fetiches of

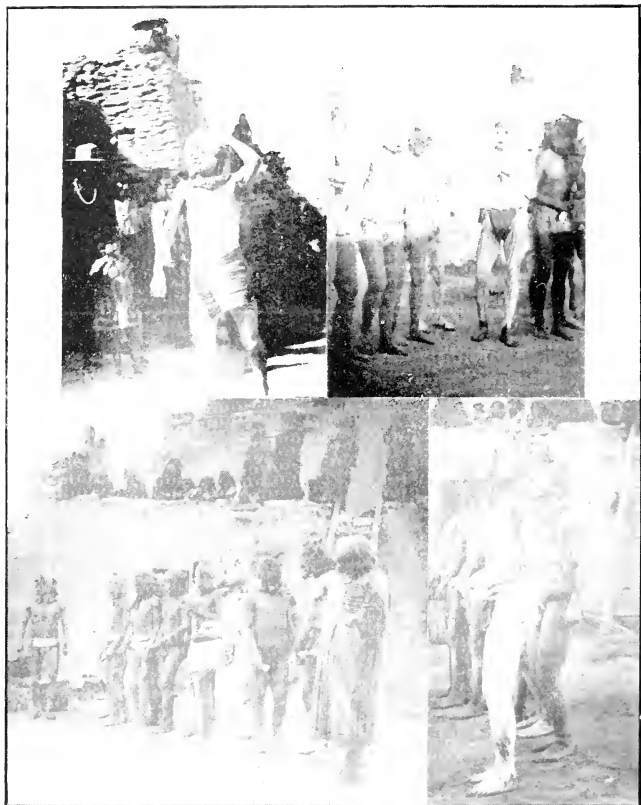
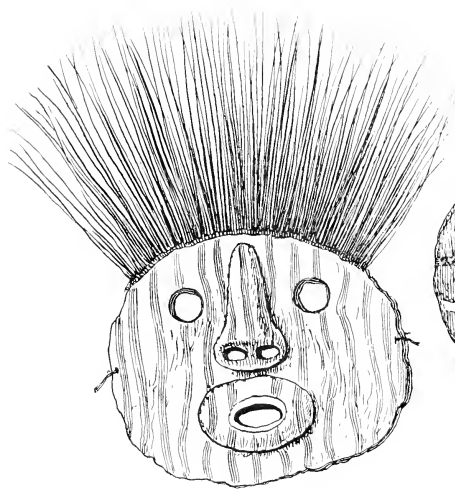
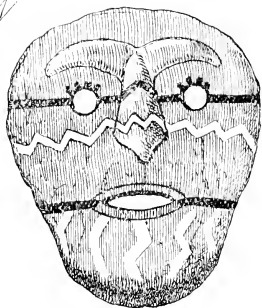


PLATE I.



1.



2.



3.



4.

PLATE II.

the same in the Snake Ceremony were brought up from the underworld,¹ or certain explanations of why certain ceremonials are performed have been handed down from the ancients, no one can doubt. But human invention has been fertile through that lapse of time and local coloring has modified the explanations until it may have lost much of its original value. It is more than we can expect that the priests officiating in a ceremony can give other than a traditional explanation. His testimony is a valuable contribution to an understanding of local modifications, but the question is too great for him to answer. The insidious influence which leads the observer to enlarge upon possible explanations suggested by priests who may have received their explanations must be carefully controlled, otherwise folk-lore becomes useless as a scientific contribution. At most the explanation given by priests is only one means to bring to a solution of the question of the meaning of religious ceremonials and its limitation should be properly recognized.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. *Hü-hu-wuh.*
 Fig. 2. *Ute-cē-ē-kā-tci-nā.*
 Fig. 3. Line of *Tā-tcuk-ti* with priest awaiting the contestants in the race.
 Fig. 4. *Kē-se-kā-tci-nā.*

PLATE II.

- Fig. 1. Mask of *Ute-cē-ē* used in the *Hu-mīs-kā-tci-nā.*
 Fig. 2. " " *Ute-cē-ē.*
 Fig. 3. " " *Ute-cē-ē* from the *kib-va*, not observed to be worn in the race or in a dance.
 Fig. 4. Mask of *Hu'-hu-wuh.*

¹The Hopi, in common with some other pueblo people, believe that men came upon the surface of the earth crawling out of an opening near the San Juan river, and called *Sí-pā-pu*. The Tusayan Tewans claim that they did not issue from the same *Sí-pā-pu* as the Hopi but from another in the far east, which they call *Sí-p'o-p'o-nē*.

ANNALS OF THE SEA SERPENT.

A "SEA SERPENT."

THE appearance in Gloucester (Cape-Ann) harbor of an uncommon *Sea Animal* has been the topic of conversation and wonderment for several days past. A number of gentlemen of information and veracity have asserted, that they have seen such an animal off and in that harbor, reposing at times on a smooth sea, and had thereby an opportunity to see and judge of its form and dimensions. Their accounts, though in some instances dissimilar, all agree that this animal is of the species called the *Sea Serpent*. It is described as having its head (like those given to serpents in prints) at times, out of water; that to some it appeared as large as the head of a horse—to others, varying, perhaps, according to distance, as that of a large dog;—that its body was round like a snake's, but connected by joints, which to some appeared like a row of ten-gallon kegs, and to others like barrels; that its length was estimated by some to be 40 feet, by others 30, 100, and over; that its motion was serpentine, erratic, and rapid for an animal of its bulk; that it has been seen lying on the surface of the water, with parts of its body from six to eighteen inches out of the water, and its tail nearly on a line with its head; that it frequently forms circles in its movements, and in its progress sometimes leaves a wake of a mile in length.

Measures have been taken, and others are contemplated,

for killing and exhibiting this animal. It is hoped they will succeed. The *Encyclopedists* have doubted the existence of such animals as *Sea Serpents*, which have been described by some navigators, particularly by Egede as frequenting the Greenland seas some of which have been described as extending its head as high as the main-top-mast of a ship, its body being as thick as a hogshead, its skin variegated like a tortoise shell, and its excrement corrosive.

The *Salem Gazette* of yesterday says, "We are informed, that on Sunday this creature was seen playing sometimes within 15 or 20 feet of the shore, affording a better opportunity to observe him than had before occurred. Gentlemen from Gloucester state, that he appeared to them of an even greater magnitude than had before been represented, and should judge from their own observation, that he was as much as 150 feet in length, and as big round as a barrel. They saw him open an enormous mouth, and are of opinion that he is cased in shell. The chance for taking or killing this creature seems to be small; it requires not merely the club of a *Hercules*, but the cunning contrivance of a *Vulcan*. We understand, however, that it is proposed to make a number of strong nets, in the hope of entangling and embarrassing him, so as to be able to get him into a situation to kill him; in which we rather wish than expect they may prove successful."

Corroboration. Capt. Obear, who has arrived at Beverly, reports, that on Sunday last he put into Cape-Ann harbor, where he and his crew were astonished at the sight of a monstrous creature lying upon the water, which appeared to have the form of a serpent.

Whatever doubts may have existed on this subject, there are hundreds who can testify to the existence of some creature of a very uncommon bulk and form, and such as was never before seen upon our coast.

The bold adventurers (says the *Salem Gazette*) who are fishing for the Sea-Monster at Cape-Ann, ought to be furnished with the implements mentioned in the following lines :—

“THE GIANT ANGLING.”

“His angle-rod made of a sturdy Oak,
His line a Cable that in storms ne'er broke;
His hook he baited with a Dragon's tail,
And sat upon a rock and bobb'd for whale.”

Boston Centinel, Aug. 20, 1817.

IMMENSE SEA SERPENT.

(A FISH STORY.)

A species of Sea-Serpent was thrown on shore near Bombay in 1819. It was about forty feet long, and must have weighed many tons. A violent gale of wind threw it high above the reach of ordinary tides, in which situation it took nine months to rot; during which process travellers were obliged to change the direction of the road for nearly a quarter of a mile, to avoid the offensive effluvia.

It rotted so completely that not a vestige of bone remained. (From 10,000 Wonderful things, by Edmund F. King, London.)

The *Massachusetts Gazette*, Sept. 26, 1784, says—
“Captain Wyatt of the ship *Whale* writes to his friends in London, that he has been within a few leagues of the North Pole; and that at the Pole there was a most dreadful eruption of nitre, which proved there was a volcano. Crystallized substance, like glass fell near Capt. Wyatt, which refracted the light; by this he accounts for the *Aurora Borealis*.”

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JUL

1893

BULLETIN

OF THE

ESSEX INSTITUTE.

VOL. 24. SALEM: OCT., NOV., DEC., 1892. Nos. 10, 11, 12.

ANNUAL MEETING, MAY 18, 1892.

THE annual meeting was held in Plummer Hall, this evening, at 7.30 o'clock; Vice President A. C. Goodell, jr., in the chair. The record of the last annual meeting was read by the Secretary.

The reports of the Secretary, Treasurer, Auditor, Librarian, and the Publication Committee were read, accepted and ordered to be placed on file.

The report of the committee on nominations was presented by Geo. M. Whipple, and it was

Voted, to proceed to the election of officers for the ensuing year. Messrs. Phippen, Morse and Welch were appointed by the chair to distribute, collect, assort and count votes. This committee reported the following list of names as receiving all the ballots, and these officers were declared unanimously elected:

PRESIDENT:

HENRY WHEATLAND.

VICE-PRESIDENTS:

ABNER C. GOODELL, JR.,

DANIEL B. HAGAR,

FREDERIC W. PUTNAM,

ROBERT S. RANTOUL.

SECRETARY:

HENRY M. BROOKS,

TREASURER:

WILLIAM O. CHAPMAN.

AUDITOR:

GEO. D. PHIPPEN.

LIBRARIAN:

CHARLES S. OSGOOD.

COUNCIL:

WILLIAM H. GOVE,

S. ENDICOTT PEABODY,

THOMAS F. HUNT,

DAVID PINGREE,

DAVID M. LITTLE,

EDMUND B. WILLSON,

RICHARD C. MANNING,

GEORGE M. WHIPPLE,

EDWARD S. MORSE,

ALDEN P. WHITE.

REPORT OF THE SECRETARY.

Since the last annual meeting there have been twenty-two meetings of the society and two meetings of directors.

There have been two field meetings during the last season, one at Bartholomew's Pond, South Peabody, July 1, 1891. About thirty persons attended this meeting. Vice President Hagar presided, and after a few introductory remarks introduced Mr. John H. Sears, who spoke of the plants of the region, and Mr. Cyrus M. Tracy of Lynn, who made some remarks on the flora of the vicinity. The speakers were interesting and instructive, and the meeting, though a small one, was enjoyed by all who took part in it. The second meeting was on Wednesday, September 16, at Bradford Academy, where some thirty persons con-

nected with the Institute, by invitation, dined with the venerable President, the teachers and the members of the senior class of the Academy. Vice President Hagar presided at the meeting, and remarks were made by Dr. Cogswell, Prof. E. S. Morse, John Robinson, Esq., John H. Sears, Esq., and others. The day was fine and all who participated in the meeting were much pleased.

During the past season papers have been read before the society, in Plummer Hall, by the following persons :

Wm. A. Mowry, Esq., on "U. S. Boundaries and Boundary Commissions."

A. A. Post, Esq., of Boston, on "Volapuk."

Rev. G. T. Flanders, D.D., on "Our Aryan Ancestors."

Rev. Joseph Kimball, of Andover, on "Arts: Present and Future."

Prof. Edw. S. Morse, on "Japanese Pottery."

Sidney Perley, Esq., on "Prehistoric America."

Mr. J. Walter Fewkes, of Boston, on "Study of an Aboriginal Ceremonial."¹

Rev. A. P. Putnam, D.D., of Concord, on "Wenham Lake Ice Co."

Sylvester Baxter, Esq., of Boston, on "Municipal Democracy."

Col. Henry Stone, of South Boston, on "General Sherman."

Rev. E. O. Dyer, of South Braintree, on "Coligny and the Huguenots."

Dr. J. E. Wolff, of Cambridge, on "The History of Rocks learned by the Microscope"—with lantern illustrations.

Dr. P. C. Knapp, of Boston, on "Hypnotism."

¹See Bull. Essex Inst. Vol. XXIV, p. 113.

Hon. Alden P. White, of Danvers, Readings from Tennyson.

Ezra D. Hines, Esq., of Danvers, on "A Day at Lexington."

All these lectures have been well attended.

On the 29th of February, the 200th anniversary of the Witchcraft delusion in Salem (in February, 1692) a meeting was held by this society in Academy Hall where there was a very large and interested audience present. Upon the stage were Prof. D. B. Hagar, Prof. E. S. Morse, Rev. C. B. Rice of Danvers, Mayor Rantoul, Prof. Barrett Wendell of Harvard College, Hon. A. C. Goodell, jr., W. S. Nevins, Esq., Rev. Dr. A. P. Putnam of Concord, Wm. A. Mowry, Esq., of Salem, Ross Turner, Esq., and the Hon. Chas. S. Osgood.

Mr. Nevins called the meeting to order, read the warrant for the arrest of Sarah Good, Feb. 29, 1692, and in a few remarks introduced the Mayor of the city, as the Chairman of the meeting. Addresses were delivered by Professor Wendell, Rev. Mr. Rice, Mr. Goodell and Mr. Mowry. The meeting was considered a decided success. The *Evening News* said—"The audience was an intelligent and interesting body," and that all the speakers had given the subject a careful study.

All the lectures have been free to the public and it is believed have given satisfaction. Reports were printed in the Salem papers.

There have been 686 donations to the cabinets, from 135 different donors the past year. These donations have been acknowledged through the mail and in the *Salem Gazette*.

More than 7300 persons have visited the old meeting house of the First Church, and the question "How did they

get up in the gallery?" has been answered at least 5,000 times the past year.

Thirty-three persons have joined the society during the year, and seventeen members have died, viz. :

Augustus S. Browne,	George Roundy of Beverly,
Rufus B. Gifford,	John H. Silsbee,
Nathaniel A. Horton,	Frank Stone,
Catherine K. Ireson,	Stephen G. Wheatland,
George R. Lord,	Cyrus M. Tracy of Lynn,
George B. Loring,	James D. Waters,
Martha A. Nichols,	Charles Woodbury,
George Peabody,	Martha A. Willson,
	John Webster.

In the historical department the collections are continually increasing, and I can now only repeat in substance what was said last year on this point.

Additions to our building and funds are greatly needed to make a proper display of the important donations to the cabinets and to arrange and catalogue the manuscripts.

It is desired that the members generally will help us at least to increase our membership, which can be easily done if the matter should be taken hold of earnestly. If, for instance, every member should feel it incumbent on himself or herself to obtain for us two new members in the coming year, it would be a very great aid to us and help to "bridge over" to the time, when it is hoped some one or more of our friends will contribute a hundred thousand dollars to the funds of the society.

The Institute is also in need of more young persons, of both sexes, for members, and especially those who would be interested in our work and would aid us in arranging the various collections. Of course we want old people too, but no society can long exist without the coop-

eration of the young and enthusiastic. It might reasonably be supposed that for the credit of Salem if for no other reason, the young would come forward and beg to assist in the work of the Institute.

On the 9th day of January last, a committee, consisting of Mayor Rantoul, Ross Turner, D. B. Hagar, David M. Little, W. S. Nevins, Francis H. Lee, John Robinson, Eben Putnam, Thomas F. Hunt and the secretary, was chosen by the society to arrange for an exhibit of the Institute at the great Exposition to be held in Chicago next year. This committee has held several meetings and has formulated a plan which when carried out will ensure such a representation of the society at this Columbian Exposition, as will redound to its credit, and also to that of the city and county. The committee has arranged to have this exhibit placed in the main reception room of the Massachusetts Building, and the committee is empowered to form a general committee, which shall take charge of the whole matter of raising the necessary funds and attending to the numerous details which such a work requires. The full report of this committee will be presented to the society when plans are somewhat farther arranged.

A special committee consisting of Messrs. Turner, Nevins and Morse was appointed on the 11th day of last January, to take charge of the Witchcraft meeting on the 29th of February, and as that meeting was only preliminary to the erecting of a Memorial to the victims of the delusion, the committee will probably report at a meeting of the society a plan looking towards the carrying out of this idea to a successful termination. Much interest has been shown in it especially by other historical societies and students.

During the month of November last, an exhibit of Water

Colors by Misses Emily P. Mann, Sarah S. Kimball and Mary M. Brooks, and Messrs. Arthur W. Dow, Dwight Blaney and Ross Turner, was held in the rooms of the society. It was opened free to the public, the attendance was very good, and the exhibit received much favorable notice. I would suggest that during the summer months it would perhaps be well to utilize Plummer Hall for a water-color exhibition, so many people visit our town during these months that it might be made an additional attraction.

During last season the Institute entertained many parties from kindred and other societies including the Rhode Island Historical Society, the Massachusetts Library Club, classes from Bradford and other schools, etc., and already this season a desire to visit Salem is shown on the part of one or two historical societies. These visits are very helpful, not only in the way of getting our members acquainted with those from other states who are engaged in the same work, but also obliging us to keep somewhat well posted in the history of our own town in order to answer properly the questions that are asked in regard to the different historical sites, etc.

I have so often suggested that the Institute would like to receive anything and everything of historical value, that I am sure you would hardly consider my report complete without again calling your attention to this matter. I want to see this collection grow to such an extent that an entire new building will be needed to display it properly, and I wish we had the building now and the funds to support it, for we need a handsome endowment to carry on the work of the society as it should be done.

Respectfully submitted,

HENRY M. BROOKS,

Secretary.

REPORT OF THE LIBRARIAN.

The additions to the library for the year (May, 1891 to May, 1892) have been as follows :

By Donation.

Folios,	45
Quartos,	186
Octavos,	1,058
Twelvemos,	346
Sixteenmos,	306
Twenty-fourmos,	106
Total of bound volumes,	2,047
Pamphlets and serials,	8,041
Total of donations,	10,088

By Exchange.

Folios,	10
Quartos,	16
Octavos,	142
Twelvemos,	61
Sixteenmos,	30
Twenty-fourmos,	22
Total of bound volumes,	281
Pamphlets and serials,	2,728
Total of exchanges,	3,009

By Purchase.

Folios,	4
Quartos,	29
Octavos,	139
Twelvemos,	53
Sixteenmos,	24
Twenty-fourmos,	45
Total of bound volumes,	294
Pamphlets and serials,	939
Total of purchases,	1,233
Total of donations,	10,088
Total of exchanges,	3,009
Total of purchases,	1,233
Total of additions,	14,330

Of the total number of pamphlets and serials, 4,396 were pamphlets and 7,311 were serials.

The donations to the library for the year have been received from one hundred and seventy-one individuals and

ninety-eight societies and governmental departments. The exchanges from eleven individuals and one hundred and seventy-four societies and incorporated institutions, of which ninety-one are foreign ; also from editors and publishers.

The largest donation has been that of Dr. Wheatland's scientific library numbering over four hundred volumes.

The set of *Littell's Living Age* is now complete to August, 1891, and the set of *Scribner's Monthly* lacks only three numbers.

The librarian in presenting these statistics congratulates the members of the Essex Institute on the growing value of the library in all its reference departments. The Public Library and Athenæum furnish the popular books for general circulation, while the Institute aims to build up a large and valuable reference library. Here should be found the many books of little interest to the casual reader, but sometimes of inestimable value in the prosecution of certain lines of study and research. The pleasant rooms of the Institute are always open to students and investigators in any branch of literature or science, as well as to the general reader, and every assistance is given them in the prosecution of their work. So far as possible the books are arranged in the different rooms by subject, but there is great need of a catalogue or finding list so that it can be readily ascertained what books are in the library relating to any special subject. Some work has been done in this direction but the lack of funds prevents its being pushed forward as rapidly as it should be.

The growth of the library brings each year more sharply to our attention the need of additional room for the storage of books. This want will have to be met in some way in the near future and all action should be taken with this end in view.

A quiet and uneventful, although a useful and prosperous year for the library leaves little to be said in the annual report. The influence of the Institute broadens, and its work is appreciated more and more as the years go by. Let us see to it that there is no halt in its progress.

CHAS. S. OSGOOD,
Librarian.

TREASURER'S REPORT.

Receipts and expenditures of the past year (condensed from the account presented).

RECEIPTS

Balance of last year's account,		\$10,557 96
Discount of note,	\$2,500 00	
Interest from Five Cents Savings Bank to be funded,	58 66	
		<u>\$2,558 66</u>
Assessment of members,	\$774 00	
Income of invested funds,	3,589 07	
Sale of publications,	889 51	
Amounts received from other sources,	140 13	
		<u>Net income,</u>
		<u>\$5,392 71</u>
		<u>\$18,509 33</u>

EXPENDITURES.

Salaries of secretary, assistant librarians and janitor,	\$2,232 75	
Cost of books, periodicals and binding	819 45	
“ “ publications and printing	1,379 26	
“ “ fuel,	181 50	
Paid for gas and water,	42 66	
“ “ repairs	151 79	
“ “ insurance,	30 60	
“ “ interest on note,	45 75	
“ “ our proportion of Salem Athenæum expenses,	226 57	
“ “ express, postage and sundries,	287 29	
“ “ annuities (obligations of legacies)	710 00	
		<u>\$6,107 02</u>
“ “ note,	1,500 00	
Investment of legacy from estate Mrs. Nancy D. Cole,		10,327 75
Interest added to manuscript fund,	51 82	
“ “ “ North Bridge monument fund,	6 84	58 66
		<u>Balance of cash on hand,</u>
		515 90
		<u>\$18,509 33</u>

May 16, 1892.

Respectfully submitted,
WILLIAM O. CHAPMAN, *Treasurer.*
Examined and approved,
(signed) GEO. D. PHIPPEN, *Auditor.*

INVESTMENT OF FUNDS

For income,	\$71,655 51
“ Essex Institute Building,	28,370 69
“ Ship Rock and land,	100 00
	<hr/>
Total investments,	\$100,126 20

Salem, May 12, 1892.

Examined the above account with the securities and found them correct.

(signed) GEO. D. PHIPPEN, *Auditor*.

REPORT OF PUBLICATION COMMITTEE.

The sub-committee appointed to take charge of the publications of the Institute report that these publications are now substantially completed up to date. There was some delay in the publication of volume twenty-three of the Bulletin, owing to the necessity of reprinting a portion of the paper by Mr. J. Walter Fewkes upon the “Cœlenterata of New England,” but this volume, which is for the year 1891, has now been issued. It contains, besides the annual report, the paper by Mr. Fewkes just mentioned, papers by Messrs. S. and H. Garman, also numbers three and four of the “Geological and Mineralogical Notes” by Mr. John H. Sears of the Peabody Academy of Science. These notes, containing the results of Mr. Sears’s work on the rocks of Essex County are especially valuable. There are now in the hands of the committee, ready for the next volume — volume twenty-four — of the Bulletin, valuable papers furnished by Prof. E. S. Morse, Mr. Fewkes, Mr. Garman and others. Of the Historical Collections, volume twenty-seven for the year 1890 has been published during the past year and contains a paper on Gov. John A. Andrew by Hon. Eben F. Stone, a continuation of Mr. Sidney Perley’s “Notes on Boxford Houses,” “Reminiscences of Capt. James Barr” by Mr. J. B. Curwen, genealogical memoranda relating to the Allen, Sparhawk and Prince families and a “Rough Subject Index to the Publi-

cations of the Essex Institute" prepared by Mr. Gardiner M. Jones. Two numbers of volume twenty-eight, for the year 1891, are already in print and there is in the hands of the committee enough material to complete the volume. The committee was fortunate in securing for this volume from Mr. H. F. Waters, some of his "English Gleanings" consisting of extracts from marriage licenses granted by the Bishop of London 1598-1639. These were carefully annotated by Mr. Waters and are of great interest and value to genealogical students. They will be found in the parts already published.

There has been one special publication issued by the committee during the year, consisting of a series of articles on "Our Trees,"—that is, the trees of Salem and vicinity—written by Mr. John Robinson of the Peabody Academy of Science. By an arrangement entered into with the late Hon. Nathaniel A. Horton, in whose paper these articles originally appeared, and by advance subscriptions obtained, the cost of this to the Institute was rendered almost nominal, and the edition, which was limited to three hundred copies, is practically exhausted. The committee believes that it is within the province of the Institute and will prove useful in keeping alive an interest in local matters to issue such publications as this whenever suitable matter for them can be procured, whether it be of an historical character or upon some branch of natural history.

In publishing volume twenty-seven of the Historical Collections the committee tried the experiment of printing it in a single volume without issuing separate numbers or parts as has been the custom heretofore. This plan seems to the committee to be more satisfactory and it is recommended that in future the Historical Collections be thus published.

While it is not to be expected that there will be a pop-

ular demand for such publications as those of the Institute sufficient to make them financially profitable, there can be no question that they are extremely valuable in maintaining the reputation of the society and as a means of obtaining exchanges. The committee believes the question worthy of careful consideration, whether these publications cannot be made of much greater value to the Institute by suitable efforts to enlarge the field of exchanges. It unhesitatingly recommends that the publications be continued and that every encouragement possible be given to those who are trying to do good historical and genealogical work, especially that relating to this locality. The committee suggests that the council consider the advisability and practicability of raising a publication fund which will furnish an income sufficient to pay all expenses of publication so that the Institute may be insured against the possibility of any pecuniary inconvenience on account of the maintenance of this department. It is recommended that the copies of the society's publications now on hand should be arranged properly by volumes and a special opportunity extended to such libraries and societies as are subscribers to these publications to complete their sets so far as possible. A new catalogue and price list of the publications should be prepared, and the committee recommends that the price to members of the Institute be placed as near cost as practicable, while the price to those not members for papers which have become scarce should be increased.

WILLIAM H. GOVE,
T. F. HUNT,
GEO. M. WHIPPLE.

LECTURES.

Monday, Jan. 4, 1892.—Wm. A. Mowry, Esq., of this city lectured on the subject of "United States Boundaries, and Boundary Commissions." Mr. Mowry first called attention to the importance of the study of the history of our own country, alluding to its rapid growth, great resources and wealth. The original United States, whose boundaries were fixed by the treaty with Great Britain at the close of the Revolutionary War, embraced a territory of 827,844 miles. Its bounds were the Atlantic Ocean on the east, the St. Lawrence River and the Great Lakes on the north, the Mississippi River on the west, Florida on the south. The first joint international commission for running a boundary line, was that between the United States and Spain, for making the line between this country and Florida. Andrew Ellicott was our Commissioner; this was in 1798-9. The lecturer described Mr. Ellicott's work. The Florida Treaty of 1819 and the Oregon Treaty of 1842, were both fully explained, as well as the Commission to settle the boundary between this country and Mexico in 1848, after the Mexican War and the Gadsden purchase of 1853 and Alaska in 1867.

The <i>original</i> territory was (in square miles)	827,844
The Louisiana purchase,	877,686
" Florida "	65,168
" Annexation of Texas	376,161
" Mexican Cession	545,783
" Gadsden purchase	45,535
Oregon	288,345
Alaska	577,390

Total 3,605,912

Our country, the speaker said, included all degrees of

latitude, from within the torrid zone, to and beyond the arctic circle and extending from the Atlantic to the Pacific and has such vast resources, as to be practically independent of the rest of the world.

Monday, Jan. 18, 1892.—A. A. Post, Esq., of Boston, lectured on the new language called "Volapük." Mr. Post is the Massachusetts Director in the North American Volapük Association. The *Salem Gazette* says of the lecture: "The least that can be said is, that it presented an array of facts very remarkable and interesting to even those who may not fully accept all of the lecturer's deductions from those facts." This language was invented thirteen years ago by a Roman Catholic priest.

For four years it remained dormant; after that it began to attract attention. University professors in Vienna first recognized its merits and established a club for the propagation of the tongue. It was subsequently welcomed in Russia, Sweden, Norway, Holland, Belgium, Italy, Spain, China and Japan, and within two years from its start, it found friends in every civilized land, and first by the learned men of the various countries. Forty-seven journals have been established and maintained either wholly or in part in Volapük. In general literature it has a bibliography of many hundreds of volumes, history, science, poetry, etc. Its clubs number one thousand, and it is used by more than one thousand mercantile houses. Lecture courses in this language have been given abroad. Mr. Post emphasized the fact that the inventor of Volapük did not propose it to be anything more than an international language. It was not intended to supplant any or all natural languages. Its position is not revolutionary or reformative. It is designed only as a supplementary language to make international communication easier. If

the Volapük should come into general use throughout the civilized world, then there would be no necessity of learning a multitude of different languages as is now the case, but the scholar or whoever wished to communicate with other countries could learn Volapük.

Monday, Jan. 25, 1892.—Rev. G. T. Flanders, D.D., of Boston lectured on "Our Aryan Ancestors." The lecturer said that the Aryan race, came from northwestern Asia, and from them all the Europeans are descended. Their language (the Sanscrit) is the root of all European languages, including even the dead languages, Latin, etc. The Sanscrit, he said, is the only perfect language known. As a proof of the common origin of all European nations he cited the fact that they all assimilate, whereas the Chinese and other nations not springing from the Aryan race will not assimilate.

No modern family knows its genealogy with greater accuracy than we can trace ours back to our Aryan ancestors, the clew being chiefly philological. The conquest of India by the English, and the discovery of Sanscrit in 1784, opened the way.

He then gave a few specimens to show how affiliations of language prove a common origin of peoples.

In conclusion, Dr. Flanders told how the Aryan race has perfected society, morals, science, art and philosophy. It seems to be their mission to link all parts of the world together and establish upon the earth a common brotherhood and a common language. Slowly, but surely, all varieties of our race are coming to be of one speech. From unity to diversity and from diversity to final unity is the irresistible law.

Monday, Feb. 1, 1892.—Rev. Joseph Kimball of An-

dover lectured on "Arts: Present and Future" or a consideration of the present and prospective condition of the domestic arts. He spoke at some length of the various uses of paper in recent years, and of the numerous and increasing applications of glass to the purposes of economy and of ornament. He referred to the marvellous talent shown in the preparation of articles of food and the use of machinery in this way. References were also made to steam and electricity for motive power, and its possible developments in the future. The lecture was illustrated by humorous anecdotes and allusions.

Monday, Feb. 8, 1892.—Prof. Edward S. Morse of Salem lectured on Japanese Pottery. The lecturer said that the most civilized nations do not necessarily produce the most artistic pottery. In the rudest tribes we sometimes find traces of high artistic merit; but where the highest cultivation is combined with artistic taste, the effect cannot fail to be charming. The Japanese are superior in these qualifications and we find them excelling all other nations in their pottery. Their pottery of any decided merit dates back not more than four hundred years. On account of the limited communications in Japan we find the pottery of each of the provinces has a distinctive character. In other countries it is of one general type. The Japanese excel in porcelain also; but in this they do not show the same originality of design. Their pottery is to their porcelain as the etching is to the steel engraving. The Japanese potter has a heavy wheel on the ground which he causes to revolve rapidly, and as he is on his knees on a level with the wheel, has complete control over the clay before him, and is thus enabled to produce the most delicate pottery. In Japan the calling of a potter is considered a very honorable one, and hence attracts the most talented

of the people. Poets and philosophers have made pottery, and much of its refinement there is due to the company the potters kept. The making of pottery in Japan is more of an art than a business. It is for the most part conducted by families and a large part of it is made to order. Nine millions of dollars are spent every year for foreign pottery by our country, and this might just as well be made at home, if our potters could be educated up to it; and in this connection the lecturer spoke in praise of the Beverly Pottery. The lecturer said the Japanese displayed artistic taste even in the most common things.

Monday, Feb. 15, 1892.—Sidney Perley, Esq., of Salem lectured on "Prehistoric America." Mr. Perley divided American history into three periods, commencing with the latest. The first covered the years from the time when explorations and attempts at settlement were made by civilized people at about the beginning of the sixteenth century down to the present era. The second covered the time when the Indians flourished here. The third or prehistoric period related to races that preceded the Indians. He spoke of man's existence here before the drift period, when the moraines and many of our knolls were formed by the flood and glacier, burying human beings beneath the gravel deposits, together with their implements of various kinds and their pottery. He mentioned the ruins of Arizona, dwelt upon "mound builders" especially and gave a very interesting sketch of the discoveries in their region principally along the banks of the Mississippi river and its tributaries. The salt mines, mica mines and the ancient copper diggings were spoken of at some length. Mr. Perley thought that the Indians and the "mound builders" were probably modern, as compared with the races of man that once existed here. He also said that geologists

agree that North America is the oldest continent geologically and probably man existed here first, so that instead of races coming here from Asia, they probably went from here to Asia. This lecture was illustrated by large crayons, of plans, sketches of mounds and drawings of idols, copper implements, pottery, etc.

Monday, Feb. 22, 1892.—The lecture this evening, by Mr. J. Walter Fewkes of Boston, was on the "Study of an Aboriginal Ceremonial." The lecturer stated that among the Moki Indians of Arizona, a series of primitive religious rites are performed of which, at least one occurs, in every month. As each of these religious ceremonials occupied nine days, it could readily be seen how much time during each year was taken up by such observances. It is impossible, to understand the meaning of them, until more is known of the details of them all. The ceremony that attracted the most attention was the Snake Dance as it is called, which is celebrated biennially in two of the pueblos. This was not the most important of their ceremonials although, from its weird character, it was the most widely known. Mr. Fewkes then proceeded to describe very fully the performance of the Snake Dance, detailing all the events, and spoke of its meaning, which he considered was a ceremonial for rain. The lecture was illustrated by stereopticon views.

Monday, Feb. 29, 1892.—The two hundredth anniversary of the beginning of the witchcraft delusion in Salem, was observed by the society at Academy Hall. There was a very large and interested audience who listened for two hours, with the closest attention, to the different speakers.

Upon the stage were Professor E. S. Morse, Professor D. B. Hagar, Rev. Charles B. Rice of Danvers, Mayor

Robert S. Rantoul, W. S. Nevins, Professor Barrett Wendell of Harvard College, Abner C. Goodell, jr., Dr. A. P. Putnam of Concord, W. A. Mowry, superintendent of the schools of Salem, Ross Turner, Hon. Charles S. Osgood and Secretary Henry M. Brooks.

Mr. Nevins called the meeting to order and said that it was not desired by the committee or by the Essex Institute that anything should be said or done to bring discredit upon the Salem of 1892 by rehearsing the story of 1692, but it was only with the hope that the matter might be so presented as to divest the name of Salem from the possible stain thrown upon it by prevalent misconceptions of the character of the people and the proceedings of that era. If Salem did not do something in presenting the truth regarding that time, other historians would, and was it not much better that the narrative should be told by their own local historians who were familiar with the subject, than that the task should be assigned to strangers. Mr. Nevins read the warrant for the arrest of Sarah Good, Feb. 29, 1692, and then presented Mayor Rantoul as chairman of the meeting.

The Mayor, on taking the chair, said :—"History imposes on us to-night a delicate and difficult task. We are here to commemorate something we would willingly forget. The witchcraft horror, the terrible frenzy which overtook our ancestors two centuries ago,—is a chapter in our local annals which I for one would make haste to blot out forever if I had it in my power to do so. All that can be said in extenuation, all that can be said to the personal credit of the few who stood up bravely against the wretched business, to the honor of Judge Saltonstall, who retired from the court rather than give his judicial sanction to the hearing of the miserable charges, to the honor of goodman Woodbury whose horse stood ready saddled, night

after night in his barn, for the use of neighbors who might be accused and might escape with his aid to New Hampshire, to the honor of the venerable ex-governor Bradstreet, of whom Upham intimates that, had he remained governor another year, the frenzy would never have gained head, to the honor of his successor, Sir William Phips, who, when Lady Phips began to be accused, looked into the matter and cried a halt, all that can be charged off to the advantage of the few who, earlier or later in the proceedings discovered their dreadful error and in humiliation and sincerity repented of what they had done,—such as Judge Sewall, Ann Putnam, the Rev. John Hale—all these things and the added plea that others elsewhere held the same beliefs, that persons as guiltless suffered like enormities in other places, before and since, under the malignant influence of this awful creed, all this does not wipe out the appalling fact that right here in Salem at the hands of our own ancestors whom we honestly revere and hold up as better than their time in many ways, twenty innocent persons, mostly women, were by their own neighbors done to death, at intervals of weeks, with slow deliberation and the forms of law, upon flimsy and unsubstantial statements, the victims denied those rites and consolations of religion which society affords to the most hardened of offenders, excommunicated from the church they loved, outlawed of heaven and earth, even the poor solace of Christian burial denied their ashes.

A phenomenon like this may well startle us from our complacency and make us pause.

It is for others to account for and explain it. The task is not for me. Scholars learned in the research of the period in question, familiar with its social atmosphere, and initiated by virtue of long investigation into the mysteries of its deluded thought, are here to address you to-night,

and it becomes me to resign the hour to them. They will offer you explanations and reflections for which their position and studies will command respect. We all have our theories. We have in the Uphams, father and son, able guides to a just conclusion. The interchange of views, on a centennial like this, cannot but be welcome and inspiring to all of us.

I find, then, an excuse for this commemoration, if excuse it need, in the belief that the wretched slaughter of women, in 1692, whether we will it or not, will be remembered. Had they perished by conflagration, by shipwreck, or by flood, by any agency where no human motive intervened, their fate had been sad indeed, but time would slowly wipe out the living memory. Had they died by Indian massacre even, or by famine or by siege, the memory of it would linger long, but not forever. Not the number of the victims, not so much the character of the victims, but the nature and animus of the violence under which they fell, determines, I think, the final judgment of mankind. Smithfield and the Inquisition will not be forgotten; the bloody upheaval in France a century ago will not be forgotten; the groundless strangulation in Salem two hundred years ago will not be forgotten.

I ask your attention, therefore, to what is about to be said, in order that we may help to record and hand down the actual fact and not expose our ancestors to the distorted misconceptions of writers who may not feel the solemn obligation resting upon us to see to it that the censure is apportioned to the fault. I shall rejoice if persons who have supposed us anxious to keep alive these memories for our own aggrandizement shall be persuaded by the solemnity of this occasion, that such is not the fact, and that while we cannot shape our history, we accept it in all seriousness as it is, and have no disposition to treat in a light

or trifling spirit the saddest of all episodes in the noble annals of a noble race."

Prof. Barrett Wendell of Harvard College was first introduced by Mr. Rantoul.

Mr. Wendell's paper,¹ while carefully disclaiming the scientific and historical learning that should give his views authority, suggested that his observation of modern occultism revealed so many points of likeness to matters testified to in the trials of the Salem witches as to lead him to believe that the witchcraft was really something resembling an epidemic of hypnotism. He further expressed belief that whoever practised hypnotism in the seventeenth century could hardly have failed to believe himself in league with the devil. From this would follow a strong probability that some of the witches may have been morally guilty.

Professor Wendell spoke of his own psychic researches. He had studied the work of the materializing mediums, which he had no doubt were indubitably frauds, and had observed the trance mediums and tried automatic writing. He dwelt especially upon the debasing and degenerating effect that all of these had upon the operator. He cited one case of an undoubtedly honest young woman who was capable of going into a trance, and who in that condition undoubtedly did things of pure charlatany and subtle untruth. He had himself found the automatic writing to leave him in such a state of nervous irritability that at times he was almost ready to admit that he himself had partially helped the pencil along, and yet when charged with it was at once eager and ready to deny it.

He had taken Mr. Upham's admirable books and had studied the life of Cotton Mather and found him not at

¹See *Ilist. Coll. Essex Inst.*, Vol. XXIX, p. 45.

all the deliberate villain he had been led to believe him. The more he read of him the more he was struck with the familiarity of his type. The controlling spirit of this grotesque tragedy, its atmosphere, had something which he had known in his own experience. It was a horribly tragic fraud then and is a strangely grotesque one to-day. He cited the case of Mary Warren in her fits as one of undoubted hypnotism. These girls had apparently carried hypnotism to excess, and partook of just such consequent moral debasement as we see to-day, about the purlieus where occultism in its lowest forms is practised. The bulk of the evidence was spectral. It was this absurd evidence which hung the witches; it was its rejection which stopped the witchcraft trials.

The case of Rebekah Nurse was another instance of excessive hypnotism. Rebekah Nurse bent her neck and immediately all of the afflicted had their necks similarly twisted. This was nothing against Goody Nurse, but when Abigail Williams cried out to set the neck of the accused straight or Elizabeth Hubbard's neck would break off, it simply showed that Betty Hubbard's vision was so greatly diseased by hypnotism that she was involuntarily under its subjection. From this, the speaker asked, with their awful view of Calvinism, was it not probable that these people ascribed this condition to God or Satan?

Rev. Charles B. Rice of Danvers was introduced as the successor of Samuel Parris. Mr. Rice made a witty speech. He said he had come down more especially to see that the sin of Salem in this witchcraft business was not all shoved off upon Danvers. The fact was that the delusion was short and sharp in Danvers, and then the people were prompt to confess their error. In Salem the confession was rather slow and canting.

He had said the afflicted girls were possessed of a hyp-

notie hysteria, mixed with wickedness, and he stood by that definition. The preceding speaker had stated their case pretty fairly, but when he expressed the view that the accused had some of this power and exerted it he should be slow to believe that. He believed each individual was guiltless.

He did not think much of Cotton Mather who was brought up precociously and flattered too much when a boy, and thought a great deal too much of as a minister. He thought we should be slow to admit that our fathers were worse than their generation in the world.

Mr. Rantoul then read the following letter from William P. Upham :

Newtonville, Mass., February, '92.

W. S. NEVINS, ESQ.

MY DEAR SIR :—

Your kind invitation to attend the meeting of the Essex Institute, February 29th, is received. I regret very much that I shall be unable to be present.

One of the many signs of the amelioration in the general tone of public sentiment which the more advanced thought of our day has produced is the tender regard paid to the memory of the unfortunate victims of the sad delusion of 1692.

I am glad the Essex Institute proposes to give expression to this feeling.

Very truly yours,
WM. P. UPHAM.

Dr. William A. Mowry was next introduced and spoke substantially as follows :—

“Talleyrand is credited with saying that words were invented to conceal one's thoughts. It would seem, sometimes, that history was invented to keep out of sight the facts which have taken place in the past, and to substitute therefor a series of tales, legends and slanders concerning those who have lived before our time, which sometimes are scarcely even founded on fact.

In the recent ecumenical conference in Washington, Bishop Fowler is reported to have said he thanked God that "Methodism never whipped a Quaker, nor burnt a witch, nor banished a Baptist to Rhode Island."

This is a very striking statement. It has a ring to it. It sounds well. Probably, when it was written, it "brought down the house." Let us examine it a little. I do not propose to raise any question as to its truth. Surely, also, the triple statement is creditable to that excellent denomination of Christians. Several things, however, may be noticed about it :—

1. Methodism had no existence till well along in the eighteenth century, say about 1730. The banishment of Roger Williams, the persecution of the Quakers and the New England witchcraft, all occurred in the seventeenth century. Methodism, therefore, could not very well have anything to do with these occurrences.

2. New England never burnt a witch.

3. Roger Williams, when ordered to leave the Bay Colony, was not a Baptist, had no intention of becoming one, and did not become one till at least three years subsequent to his founding his settlement in Rhode Island.

The well-known S. S. Cox, in a speech defending the South, once spoke of witches having been burnt in Massachusetts. Senator Vance, of North Carolina, only a year or two ago in a speech alluded to Massachusetts as having burnt witches at the stake.

Now, so far as I know, the only witches ever burned at the stake in this country were burned at the South, and that long after the Massachusetts Bay Colony had set the example to the world of opening the jail doors, and setting free all persons who had been charged with witchcraft.

The law of King James I, "against conjuration, witch-

craft and dealing with evil and wicked spirits," was declared to be in full force in South Carolina, about the year 1710, seventeen years after the famous jail opening in Salem.

The speaker defended Salem and the Massachusetts Bay Colony as being at the time of the witchcraft delusion, ahead of their time, and that their action in discontinuing all prosecutions against supposed witches in 1693, opened the eyes of the world, and that from that day witchcraft was doomed and the delusion rapidly passed away. This happy result is directly traceable to the action of the Bay colony in 1693 at Salem.

The closing speaker was Hon. Abner C. Goodell, jr., who rehearsed what he had said at Danvers briefly. He said, however, that he did not agree with Mr. Rice regarding the ministers. He thought if a consensus of their views had governed, there would not have been any executions, for they did not believe a spectre could act through an innocent person. He defended the judges from too harsh a criticism as they only followed English authorities who regarded witchcraft as one of the worst of crimes. He alluded to a most valuable work on witchcraft, Rev. Samuel Willard's, which contained the opinions of Philip English and John Alden after their return from banishment.

Monday, March 7, 1892.—Rev. A. P. Putnam, D.D., of Concord, Mass., lectured. His subject was "The Wenham Lake Ice Company." Dr. Putnam first spoke of the great value of ice for its various purposes and alluded to the manner in which the Greeks and Romans preserved their snow for summer consumption; and then spoke briefly of the old New England family ice-houses half under ground or set into the declivity of a hill. He also gave a history of the early export ice trade of New England which was begun about 1805, by Frederick Tudor of

Boston, and continued by him and others shipping ice to the East and West Indies down to 1860 or later, The Wenham Lake Ice Company was first formed in Danvers largely through the influence of Mr. Joshua Sylvester in 1847. A partnership was formed by Henry T. and Joseph W. Ropes, natives of Salem, and Wm. L. Weston for the purpose of gathering and exporting ice to England; a similar business had been started a few years before by Charles B. Lander and others of Salem, who had offices in London and Liverpool and ice-houses on Wenham Lake. Dr. Putnam spoke at some length of the character and enterprise of the Messrs. Ropes and other Danvers and Salem people, and in this connection paid a tribute to the worth of Messrs. Reuben W. and Ripley Ropes, natives of Salem whom he had known in Brooklyn, N. Y. The ice from Wenham Lake came to be known all over Great Britain, for its purity, so that at length some English ice dealers purchased a lake in Norway and named it Wenham Lake, and it is said, that at this day signs can be seen in British ports of "Wenham Lake Ice," which is known to have been imported from Norway.

Monday, March 14, 1892.—Sylvester Baxter, Esq., of Boston, lectured on "Municipal Democracy." The speaker said that our large cities were the worst governed of any in the world. It was caused by a neglect of public affairs by the better element of citizenship, leaving the matter of municipal government to the self-seeking and unscrupulous, and, as a result, we have official incapacity, sectionalism, wastefulness, high tax rate with low returns, etc. This popular neglect and indifference are the main factor in the problem. The majority prefer good government to bad, as has been demonstrated in times of popular uprisings against glaring evil. The burden of taxation is

distributed among the common people. The burden of the waste of funds of a city does not fall mainly upon capitalists, but on the daily wage earners, in the shape of higher prices for shelter, food, etc.

Under certain conditions a high tax rate may be the truest economy, as when it is accompanied with wise outlays. The lecturer spoke of foreign models, notably among the best was Berlin, where it is considered an honor to be a member of the city government.

Monday, March 21, 1892.—Col. Henry Stone of South Boston, lectured on the "Life and Character of General Sherman." The lecturer said, no man of recent times has received so much unmeasured praise as General Sherman. He then proceeded to give in detail an interesting sketch of the General's eventful life, whose most marked characteristics he said were his mental and physical activity. He was a tremendous worker, and his mind was always alert, vigorous, inquisitive and energetic. Wherever he went he was a leader. His writings are full of pungent sayings, and he was master of the pen, if not always of the sword. He was overflowing with loyalty and devotion to his country, and some of his letters, especially that to the Governor of Louisiana, resigning his place there, deserve to be written in letters of gold.

Monday, March 28, 1892.—Rev. E. O. Dyer of South Braintree, lectured on "Coligny and the Huguenots." He gave a sketch of Coligny's life, of his birth, training, military advancement, imprisonment and acceptance of the "reformed faith," and also of his attempt to plant a colony of French Protestants in Florida; his successes, the massacre of St. Bartholomew, his murder, and the estimate of his worth were all alluded to, the speaker

saying that he was one of the finest characters in history. Mr. Dyer gave a sketch of the Huguenot movement from the death of Coligny down to the French Revolution. He also gave a very graphic account of the Huguenots from the time of the Edict of Nantes in 1598, to its revocation in 1685, and spoke of the emigration of the Huguenots to America, South Carolina, New York and Massachusetts.

Monday, April 4, 1892.—Dr. J. E. Wolff of Boston, lectured on the "History of Rocks learned by the Microscope." This was accompanied by graphic illustrations on the screen. The nature of rocks was first dwelt upon as forming part of the crust of the earth, and the manner in which they came to occupy the positions, where we now find them, explained—Thus rocks may have come in a melted state from deep down in the interior of the earth, and either have solidified at a depth, or pushed their way to the surface and flowed as the lavas of the present day; these are the volcanic or eruptive rocks,—or, the waves, washing along beaches and rivers carrying down sediment, may have piled up masses of sand and mud, which in the course of ages were buried with further masses hardened and consolidated, and thus our present sandstones and slates formed,—or in the deep water of the sea small organisms by their shells or in other ways may have formed the great beds of limestones which we use for our lime and building stone. After the rocks in these different ways have taken their places in the crust, they have shared in the great movements of the solid crust of the globe. The slow processes of decay have more or less affected the minerals of the rocks. Various illustrations of the processes of preparing thin slices of rock for the microscope were shown and explained. The lecturer spoke in conclusion

of the fine collections made by Mr. Sears at the Peabody Academy of Science.

Monday, April 11, 1892.—Dr. Philip C. Knapp of Boston, lectured on "Hypnotism." The speaker after stating that hypnotism was by no means a new discovery, proceeded to give some historical account of it from the time it was first heard of in the sixteenth century down to the present time. He then gave a detailed statement of what hypnotism is;—an induced artificial sleep, with an increase of reflex excitability and of suggestibility. It has nothing to do with magnetism or personal influences. Any one can hypnotize, but only a limited number can be hypnotized. A prominent characteristic of people in this state is that they respond to every idea suggested to them. If told that they are paralyzed or drunk, they act in accordance with the idea suggested. Instances were given of very curious results of suggestions. It is not however due entirely to suggestions, for animals can be hypnotized. It is closely allied to hysteria and is regarded as an acute mental disease. Its use might lead to insanity. Persons under its influence might be led to do improper acts, sign papers, impart information, or commit crimes.

Monday, April 25, 1892.—Hon. Alden P. White read in the lecture course, in a most interesting manner, selections from the poet Tennyson, which best illustrated the story of "The Passing of King Arthur" as told in the old legends of the Round Table. A short informal talk on the subject preceded the reading.

Monday, May 2, 1892.—Ezra D. Hines, Esq., of Danvers lectured, his subject being "A Day at Lexington." In a most entertaining manner, he gave a full account of a visit of the Danvers Historical Society to Lexington in

September, 1891. He spoke of the place as a Mecca which all Americans should visit at least once in their lives. Lexington was formerly a part of Cambridge and was made a town in 1713. Mr. Hines continued with an exceedingly interesting historical sketch of the scenes in Lexington on the day of the battle, April 19, 1775.

NECROLOGY OF MEMBERS.

AUGUSTUS S. BROWNE, son of Sewell and Abigail (Kimball) Browne, was born in Seabrook, N. H., Mar. 2, 1834; elected a member of the Essex Institute, Jan. 16, 1888, and died in Salem, Jan. 25, 1892.

BENJAMIN W. CROWNINSHIELD, son of Francis B. and Sarah G. (Putnam) Crowninshield, was born in Boston, Mar. 12, 1837; elected a member of the Essex Institute, Feb. 6, 1888, and died in Rome, Italy, Jan. 16, 1892.

RUFUS B. GIFFORD, son of Thomas and Sarah P. (Ravel) Gifford, was born in Salem, Mar. 7, 1827; elected a member of the Essex Institute, Oct. 20, 1873, and died in Salem, Apr. 3, 1892.

NATHANIEL A. HORTON, son of Nathaniel and Martha (Very) Horton, was born in Salem, Apr. 16, 1830; elected a member of the Essex Institute, June 11, 1852, and died in Salem, Dec. 14, 1891.

MRS. CATHERINE K. IRESON, widow of Samuel J. Ireson and daughter of James and Catherine (Russell) Kimball, was born in Salem, Apr. 19, 1811; elected a member of the Essex Institute, Dec. 6, 1886, and died in Salem, Aug. 19, 1891.

GEORGE R. LORD, son of Nathaniel and Eunice (Kimball) Lord, was born in Ipswich, Dec. 16, 1817; elected a member of the Essex Institute, June 4, 1874, and died in Salem, Dec. 25, 1891.

GEORGE B. LORING, son of Bailey and Sally (Osgood) Loring, was born in North Andover, Nov. 6, 1817; elected a member of the Essex Institute, Jan. 10, 1855, and died in Salem, Sept. 13, 1891.

MRS. MARTHA A. NICHOLS, widow of David Nichols and daughter of Robert and Lydia (Kilburn) Proctor, was born in Salem, Aug. 2, 1810; elected a member of the Essex Institute Nov. 21, 1876, and died in Salem, Feb. 2, 1892.

GEORGE PEABODY, son of Joseph and Elizabeth (Smith) Peabody, was born in Salem, Jan. 11, 1804; elected a member of the Essex Historical Society, Sept. 6, 1828, and of the Essex County Natural History Society in 1834, and died in Salem, Jan. 3, 1892.

GEORGE ROUNDY, son of Nehemiah and Margaret (Pickett) Roundy, was born in Beverly, Feb. 20, 1824; elected a member of the Essex Institute July 3, 1865, and died in Beverly, Nov. 2, 1891.

JOHN H. SILSBEE, son of William and Mary (Hodges) Silsbee, was born in Salem, June 17, 1814; elected a member of the Essex Historical Society, Sept. 8, 1846, and of the Essex County Natural History Society, Mar. 17, 1843, and died in North Conway, N. H., Sept. 19, 1891.

FRANK STONE, son of John U. and Eliza J. (Flint) Stone, was born in Salem, Jan. 14, 1854; elected a member of

the Essex Institute, Jan. 17, 1887; died in Salem, Aug. 26, 1891.

CYRUS M. TRACY, son of Cyrus and Hannah M. (Snow) Tracy, was born in Norwich, Ct., May 6, 1824; elected a member of the Essex Institute, Oct. 6, 1858, and died in Lynn, Sept. 28, 1891.

JAMES D. WATERS, son of William D. and Abigail (Devereux) Waters, was born in Salem, Oct. 28, 1832; elected a member of the Essex Institute, Feb. 3, 1853, and died in Salem, Feb. 19, 1892.

JOHN WEBSTER, son of Elijah and Sally (Dole) Webster, was born in Salem, Oct. 10, 1804; elected a member of the Essex Institute, Sept. 19, 1855, and died in Salem, Dec. 19, 1891.

STEPHEN G. WHEATLAND, son of Richard G. and Mary B. (Richardson) Wheatland, was born in Newton, Aug. 11, 1824; elected a member of the Essex County Natural History Society, Oct. 18, 1844, and died in New York, Mar. 2, 1892.

MRS. MARTHA A. WILLSON, wife of Rev. E. B. Willson and daughter of Stephen and Patty (Wheeler) Buttrick, was born in Framingham, July 20, 1817; elected a member of the Essex Institute, Nov. 7, 1887, and died in Salem, Nov. 7, 1891.

CHARLES WOODBURY, son of Israel and Susan (Luscomb) Woodbury, was born in Salem, N. H., Jan. 28, 1831; elected a member of the Essex Institute, Nov. 18, 1889, and died in Salem, Sept. 16, 1891.

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Bonn, Naturhistorischer Verein der Preussischen Rhein- lande u. Westphalens, - - - - -		2
Bordeaux, Académie Nationale des Sciences, Belles- Lettres et Arts, - - - - -	1	

Boston, Appalachian Mountain Club, - - - -		3	
Boston Art Club, - - - - - - - -		2	
Boston Board of Health, - - - - - - - -	2		11
Boston, Bunker Hill Monument Association, - - -	1		
Boston, City of, - . - - - - - - - -	3		
Boston City Auditor, - - - - - - - -	1		
Boston Dental College, - - - - - - - -			1
Boston, Massachusetts Bureau of Statistics of Labor,	2		
Boston, Massachusetts General Hospital and McLean Asylum, - - - - - - - - - -			1
Boston, Massachusetts Historical Society, - - -	1		
Boston, Massachusetts Humane Society, - - - -			2
Boston, Massachusetts Medical Society, - - - -	1		
Boston, Massachusetts State Board of Agriculture, -	1		4
Boston, Massachusetts State Board of Health, - -	2		48
Boston Museum of Fine Arts, - - - - - - - -	1		
Boston, New England Historic Genealogical Society,			
- - - - - - - - - - Newspapers,			5
Boston Public Library, - - - - - - - - - -			34
Boston Society of Natural History, - - - - - -			2
Boston Superintendent of Public Schools, - - - -			1
Bostonian Society, - - - - - - - - - -			1
Bousley, George E., - - - - - - - - - -	7		
Bowes, James L., Liverpool, Eng., - - - - - -	1		
Bradford Academy, - - - - - - - - - -			1
Braunschweig, Verein für Naturwissenschaft, - - -			1
Bremen, Naturwissenschaftlicher Verein, - - - -			1
Bremer, L., St. Louis, Mo., - - - - - - - -			1
Briggs, Miss M. E., - - - - - - - - - -			1
Bristol Naturalists' Society, - - - - - - - -			2
Brooklyn (N. Y.) Library, - - - - - - - - - -			1
Brooklyn, N. Y., Pratt Institute, - - - - - - -			1
Brooks, Miss E. M. R., - - - - - - - - - -	3		
Brooks, Henry M., - - - - - - - - - - Newspapers,	2		14
Brooks, Mrs. Henry M., - - - - - - - - - - Newspapers,			2
Brown, Arthur H., - - - - - - - - - - Newspapers,			2
Brown, Mrs. Lucy S., - - - - - - - - - -	64		
Browne, Alice, - - - - - - - - - -	2		38
Browne, Mrs. C. Warren, - - - - - - - - - -	7		
Brownell, T. Frank, New York, N. Y., - - - - -	9		
Brünn, Naturforschender Verein, - - - - - - -	1		1
Brunswick, Me., Bowdoin College, - - - - - - -			2
Bruxelles, Académie Royale des Sciences, des Letters et des Beaux Arts de Belgique, - - - - - - -			7

Bruxelles, Société Belge de Microscopie, - - -		10
Bruxelles, Société Entomologique, - - - -		1
Buck, James S., Milwaukee, Wis. - - - -	5	
Buenos Aires, Sociedad Científica Argentina, - -		9
Buffalo (N. Y.) Historical Society, - - - -		1
Buffalo, N. Y., Society of Natural Sciences, - - -		1
Burnham, Mrs. Horace C., - - - -	15	
Caen, Académie Nationale des Sciences, Arts et Belles- Lettres, - - - -		1
Calcutta, Geological Survey of India, - - - -	2	7
Calcutta, Indian Museum, - - - -		6
Cambridge, Harvard University, - - - -	6	3
Cambridge, Museum of Comparative Zoölogy, - -		11
Cambridge, Peabody Museum of American Archaeology,		4
Capen, John, Boston, - - - -		1
Carpenter, Rev. C. C., Andover, - - - -		3
Chamberlain, James A., Boston, - - - -	2	50
Chamberlain, Mellen, Chelsea, - - - -		1
Champaign, Illinois State Laboratory of Natural History,		4
Chapel Hill, N. C., Elisha Mitchell Scientific Society, -		2
Chapple, William D., - - - -	1	
Charleston, West Virginia Historical and Antiquarian Society, - - - -	12	29
Chever, Edward E., San Francisco, Cal. - - -		1
Chicago (Ill.) Historical Society, - - - -		2
Chicago, Milwaukee and St. Paul Railway Company, -		1
Chicago (Ill.) Public Library, - - - -		17
Chicago, Rock Island and Pacific Railway Company, .		1
Christiania, Université Royale, - - - -	1	4
Christiania, Videnskabs-Selskabet, - - - -		9
Cilley, J. P. Rockland, Me., - - - -		9
Cincinnati, Historical and Philosophical Society of Ohio,		2
Cincinnati, Ohio Mechanics' Institute, - - - -		1
Cincinnati (O.) Public Library, - - - -		2
Cincinnati (O.) Society of Natural History, - - -		3
Cleaves, Emery, - - - -	1	
Cleveland, O., Western Reserve Historical Society, -		1
Cole, Mrs. N. D., Estate of, - - - Newspapers,	123	17
Columbus, Ohio Meteorological Bureau, - - -		2
Conant, Samuel M., Pawtucket, R. I., - Newspapers,		
Conant, William P., Charleston, S. C., - Newspaper,		
Copenhagen, Société Royale des Antiquaires du Nord,		1
Crisp, F. A., London, Eng., - - - -	1	
Curwen, George R., - - - -	12	4

Curwen, James B., - - - - -	5	65
Cushing, Mrs. Elizabeth S., Dorchester, - - -	10	
Cutter, Abram E., Charlestown, - - - - -		1
Dalton, Edward A., - - - - -	1	
Danzig, Naturforschende Gesellschaft, - - - - -		1
Darmstadt, Verein für Erdkunde, - - - - -		1
Davenport, George F., - - - - -	1	
Dedham Historical Society, - - - - -		5
Denver (Col.) Public Library, - - - - -		1
Derby, Perley, - - - - -		1
Detroit (Mich.) Public Library, - - - - -		2
Dodge, Edwin H., - - - - -	2	
Dresden, Naturwissenschaftliche Gesellschaft "Isis,"		1
Drexel Institute, Philadelphia, Pa., - - - - -		1
Dublin, Royal Irish Academy, - - - - -		7
Dublin, Royal Society, - - - - -		9
Edes, Henry H., Charlestown, - - - - -		
- - - - - Newspapers and Circulars,	191	1373
Edinburgh Royal Society, - - - - -	1	
Emden, Naturforschende Gesellschaft, - - - - -	1	
Emerton, James, - - - - -		2
English, Mrs. James E., New Haven, Conn., - - -	1	
Erfurt, K. Akademie Gemeinütziger Wissenschaften, -		1
Erlangen, Physikalisch-Medicinische Gesellschaft, -		1
Exeter, N. H., Phillips Academy, - - - - -		1
Falmouth, Royal Cornwall Polytechnic Society, - -		1
Field, B. Rush, Easton, Pa., - - - - -		1
Firenze, Biblioteca Nazionale Centrale, - - - - -		26
Folsom, A. A., Boston, - - - - -		2
Foster, Joseph, Portsmouth, N. H., - - - - -		1
Frankfurt-a-M., Senckenbergische Naturforschende Ge- sellschaft, - - - - -	1	2
Frear, William, State College, Pa., - - - - -		4
Freiburg, Naturforschende Gesellschaft, - - - - -		2
Friends' Book Store, Philadelphia, Pa., - - - - -		1
Genève, Société de Physique et d'Histoire Naturelle, -	2	
Gibbs, Warren, St. Albans, N. Y., - Newspapers,		
Gillis, James A., Winchendon, - - Newspapers,		
Goodell, Abner C., jr., - - - - -		2
Gottingen, K. Gesellschaft der Wissenschaften - -	1	
Grand Rapids (Mich.) Public Library, - - - - -		1
Granville, O., Denison University, - - - - -		2
Green, Samuel A., Boston, Newspapers and Circulars,	61	435
Griffis, Rev. William E., Boston, - - - - -		1

Güstrow, Verein der Freunde der Naturgeschichte, -	1	1
Haddock, Mrs. H. F., - - - - -	1	
Halle, K. Leop.-Carolinische Deutsche Akademie der Naturforscher, - - - - -	1	4
Halifax, Nova Scotian Institute of Science, - - -		1
Hamburg, Verein für Naturwissenschaftliche Unter- haltung, - - - - -		3
Harlem, Société Hollandaise des Sciences, - - -		3
Harris, Miss M. A., Estate of, - Newspapers,	23	2604
Harrisburg, Pennsylvania State Library, - - -	25	
Hartford, Connecticut Historical Society, - - -		1
Hartford, Ct., Trinity College, - - - - -		2
Haskell, Mrs. A. J., West Roxbury, - Newspapers,		178
Hawken, Mrs. Thomas, - Newspapers and Circulars,	1	2
Herrick, C. L., Cincinnati, O., - - - - -		4
Hill, B. D., and W. S. Nevins, - - - - -		1
Hill, Don Gleason, Dedham, - - - - -	1	
Hill, William M., - - - - -	2	
Hobart, Government of Tasmania, - - - - -	1	1
Hobart, Royal Society of Tasmania, - - - - -	1	
Hood, I. B., Georgetown, - - - - -	1	
Horton, N. A., and Son, - - - - -		33
Hotchkiss, Susan V., New Haven, Ct., - Newspapers,		3
Howard, George E., Lincoln, Neb., - - - - -		3
Howard, Joseph J., Blackheath, Kent, Eng., - - -		1
Hunt, Miss S. E., Danvers, - - - - -	1	
Hunt, T. F., - - - - - Newspapers,	28	141
Hyde Park Historical Society, - - - - -		3
Iowa City, Ia., State Historical Society, - - - -		4
Ireson, Mrs. C. K., Estate of, - - - - -	14	147
Ithaca, N. Y., Cornell University, - - - - -	1	
Jersey City (N. J.) Free Public Library, - - - -		5
Jewett, A. S., Manchester, - - - - -	1	
Johnson, Edward F., Woburn, - - - - -	1	
Jones, Gardner M., - Newspapers and Circulars,	2	125
Kansas City (Mo.) Academy of Science, - - - -		7
Kassel, Verein für Naturkunde, - - - - -		1
King, Rufus, Yonkers, N. Y., - - - - -	1	
Kingsley, J. S., - - - - - Newspapers and Circulars,	11	249
Kjöbenhavn, Botanisk Förening, - - - - -		3
Kjöbenhavn, K. D. Videnskabernes Selskabs, - - -		3
Kjöbenhavn, Nordiske Oldkyndighe og Historie, - - -		1
Königsberg, Physikalisch-ökonomische Gesellschaft, -		1
Kruckeberg, Henry W., Los Angeles, Cal., - - -		1

Lamb, Colby, for Estate of William Leavitt, - - -	4	
Lamson, Frederick, - - - - -		19
Lancaster Public Library, - - - - -		1
Lander, Lucy A., - - - - -		1
Lander, Miss M. L., Washington, D. C., - - -	148	20
Lander, William A., - - - - Newspapers,		74
Lausanne, Société Vaudoise des Sciences Naturelles, -		3
Lee, Francis H., - - - - -	2	43
Leeds Philosophical and Literary Society, . . -		2
Le Mans, Société d'Agriculture, Science et Arts de la Sarthe, - - - - -		2
Lewis, Virgil A., Charleston, W. Va., - - - - -		3
Liège Société Royale des Sciences, - - - - -	1	
Lincoln, Nebraska State Historical Society, - - -	1	
Locke, S. D., Troy, N. Y., - - - - -		1
London Royal Society, - - - - -		8
Long Island Railroad Company, - - - - -		1
Low, Daniel, - - - - -	1	
Lowell, Old Residents' Historical Association, - - -		1
Lubeck, Naturhistorischen Museums, - - - - -		6
Luxembourg, Institut Royal Grand Ducal, - - -		2
McCrillis, R. F., - - - - -		2
McDaniel, Rev. B. F., San Diego, Cal., - - - - -		4
Madison, State Historical Society of Wisconsin, - -		1
Madrid, Observatorio de, - - - - -	3	
Mahoney, Jeremiah T., - - - - Newspapers,		
Manchester Literary and Philosophical Society, - - -		2
Manchester Museum, Owens College, - - - - -		4
Manning, Richard C., - - - - Newspapers,		
Marburg, Gesellschaft zur Beförderung der gesammten Naturwissenschaften, - - - - -		1
Massachusetts, Secretary of the Commonwealth of, -	12	2
Meek, Henry M., - - - - -	1	
Michigan Agricultural College, - - - - -		19
Michigan Central Railway Company, - - - - -		1
Middletown, Ct., Wesleyan University, - - - - -		1
Miller, Mrs. Charles H., - - - - -	17	
Milwaukee (Wis.) Public Museum, - - - - -		2
Minneapolis (Minn.) Public Library, - - - - -		2
Montgomery, James Mortimer, New York, - - - - -	1	
Montreal Natural History Society, - - - - -		5
Montreal, Royal Society of Canada, - - - - -		1
Moore, H. H., San Francisco, Cal., - - - - -		2
Morse, E. S., - Newspapers, Circulars and Maps,	2	175

Moulton, John T., Lynn, - - - - Newspapers,		
München, K. B. Akademie der Wissenschaften, - -		13
Munster, Westfälischen Provinzial Verein, - - -		1
Napoli, R. Accademia delle Scienze Fisiche e Matema- tiche, - - - - - - - - - - - - - -		15
Nashville, Tennessee State Board of Health, - -		12
Naumkeag National Bank, Newspapers and Circulars,	522	
Needham, Daniel, Groton, - - - - - - - - -		1
Nevins, W. S., - - - - - - - - - - - - -		12
Newark (N. J.) Free Public Library, - - - - -		9
New Haven, Ct., Yale University, - - - - -	1	3
New York (N. Y.) Academy of Sciences, - - - -		6
New York, N. Y., American Geographical Society, -		4
New York, N. Y., American Museum of Natural History,		8
New York, N. Y., Central Park Menagerie, - - -		1
New York (N. Y.) Chamber of Commerce, - - -	1	
New York (N. Y.) Forest Commission, - - - -	1	
New York (N. Y.) Genealogical and Biographical Soci- ety, - - - - - - - - - - - - - -		3
New York (N. Y.) Historical Society, - - - - -	1	1
New York, N. Y. Huguenot Society, - - - - -		2
New York, N. Y., Linnean Society of, - - - - -		1
New York (N. Y.) Mathematical Society, - - - -		1
New York (N. Y.) Mercantile Library Association, -		1
New York (N. Y.) Microscopical Society, - - - -		6
New York (N. Y.) Reform Club, - - - - - - -		2
New York, N. Y., Scientific Alliance, - - - - -		1
Nichols, Andrew, jr., Danvers, - - - - - - -		4
Nichols, J. Henry, - - - - - - - - - - -	1	
Nichols, Thomas B., - - - - - - - - - - -	3	
Nichols, William H., 3d, - - - - - - - - -		1
Nicholson, John P., Philadelphia, Pa., - - - - -		3
Northey, William, - - - - - - - - - - -	82	3
Norwich (Ct.) Academy, - - - - - - - - -		1
Nourse, Dorcas C., - - - - - - - - - - -		
Nunns, F. H., Baltimore, Md., - - - - - - -	1	
Nurnberg, Naturhistorische Gesellschaft, - - - -		1
Oliver, Mrs. Grace A., - - - - - - - - - -	4	13
Osgood, Charles S., - - - - - - - - - - -	132	13
Ottawa, Geological and Natural History Survey of Can- ada, - - - - - - - - - - - - - -		1
Palermo, Reale Accademia di Scienze, Lettere e Belli Arti, - - - - - - - - - - - - - -		1

Palfray, Charles W.,	- - - - Newspapers,		85
Paris, Société Nationale d'Acclimatation,	- - -		23
Paris, Société d'Anthropologie,	- - - - .		4
Parker, Mrs. William P.,	- - - - -	28	
Parker, William Thornton, Beverly,	- - - - -		1
Peabody, George L., Philadelphia, Pa.,	Newspapers,		
Peabody Institute, Peabody,	- - - - -		1
Peet, Rev. S. D., Avon, Ill.,	- - - - -		7
Perkins, George A.,	- - - - -	4	68
Perley, M. V. B., Ipswich,	- - - - -	1	
Perley, Sidney,	- - - - -	1	
Perry, Amos, Providence, R. I.,	- - - - -		1
Perry, Rev. William S., Davenport, Ia.,	- - - - -		1
Philadelphia, Pa., Academy of Natural Sciences,	- - -	1	4
Philadelphia, Pa., American Philosophical Society,	- - -		4
Philadelphia, Historical Society of Pennsylvania,	- - -		4
Philadelphia, Pa., Library Company,	- - - - -		2
Philadelphia, Pennsylvania Academy of Fine Arts,	. - - - -		4
Philadelphia, Pa., Zoölogical Society,	- - - - -		1
Phillips, Stephen H.,	- - - - Newspapers,	52	114
Pool, Wellington, Wenham,	- - - - -		2
Poole, William F., Chicago, Ill.,	- - - - -		1
Porter, Rev. E. G., Lexington,	- - - - -		2
Portland, Maine Historical Society,	- - - - .		4
Providence, R. I., Brown University,	- - - - -		1
Providence, R. I., Narragansett Historical Publishing Company,	- - - - -		2
Providence (R. I.) Public Library,	- - - - -		1
Providence (R. I.) Record Commissioners,	- - - - -	1	
Providence, Rhode Island Historical Society,	- - - - -	1	2
Putnam, Eben,	- - - - -	2	10
Quebec Literary and Historical Society,	- - - - -		1
Queensland Branch of Royal Geographical Society of Australasia,	- - - - -		1
Quimby, E. H., Malden,	. - - - - Newspapers,		1
Ramsay, Rev. William H., Middleboro',	- - - - -		4
Rantoul, Robert S.,	- - - - -	1	19
Rayner, Robert,	- - - - - Newspapers,		
Read, Warren A., Boston,	- - - - -		1
Riga, Naturforscher Verein,	- - - - -		1
Rio de Janeiro, Museo Nacional,	- - - - -		1
Roberts, Martha L.,	- - - - - Newspapers,		8
Robinson, John,	- - - - - Newspapers,	109	114

Robinson, Lucia P.,	- - - - -		1
Rochester (N. Y.) Academy of Sciences,	- - -		1
Roma, Biblioteca Nazionale Centrale Vittorio Emanuele,			13
Ropes, Mrs. Charles A.,	- - - - -	52	499
Ropes, Willis H.,	- - - - -		1
Russell, Samuel H., Boston,	- - - - -		1
Sacramento, California State Library,	- - - - -	12	51
St. Gallen, Naturwissenschaftliche Gesellschaft,	- - -	2	
St. Louis (Mo.) Academy of Science,	- - -		3
St. Louis, Missouri Botanical Gardens,	- - -	1	
St. Louis (Mo.) Public Library,	- - - - -		1
St. Paul, Minnesota Historical Society,	- - -	1	1
St. Pétersbourg, Académie Impériale des Sciences,	-		11
Salem, City of,	- - - - -	1	1
Salem Fraternity,	- - - - - Newspapers,		
Salem, Peabody Academy of Science,	- Newspapers,	1	596
Salem Press Publishing and Printing Company,	- -	2	5
Salem Public Library,	- - - - -		28
Saltonstall, Leverett, Boston,	- - - - -	1	
Sampson, Murdock & Co., Boston,	- - - - -	2	
San Diego (Cal.) Society of Natural History,	- -		6
San Francisco, California Academy of Sciences,	.		1
San Francisco, Cal., Mercantile Library Association,	-		1
'S Gravenhage, Nederlandsche Entomologische Vereeniging,	- - - - -		2
Shaw, Mary L.,	- - - - - Newspapers,		13
Sherwood, George F. Tudor, London, Eng.,	- -		1
Silver, William, Trustee,	- - - - -	1	
Smith, A. M., Minneapolis, Minn.,	- - - - -		1
Smith, Cassius C., Denver, Col.,	- - - - -		1
Smith, George Plumer, Philadelphia, Pa.,	- - -		
- - - - -	- - - - - Newspapers,		
Smith, William, Morley, New Leeds, Eng.,	Newspapers,		
South Boston, Church Home for Orphan and Destitute Children,	- - - - -		1
South Boston, Perkins Institution and Massachusetts School for the Blind,	- - - - -	1	
Spalding, J. A., for Hartford Insurance Companies,		1	
Springfield City Library Association,	- - - - -		1
Springfield, Illinois State Museum of Natural History,		3	
Springfield, Mo., Drury College,	- - - - -		1
Stavanger Museum,	- - - - -		1
Stebbins, Solomon B., Boston,	- - - - -	1	

Stewart, Alexander A., - - - - -			1
Stickney, W. J., - - - - - Newspapers,			
Stockholm, Entomologische Föreningen, - - -			3
Stone, Arthur R., - - - - - Newspapers,	12		119
Stone, George F., Chicago, Ill., - - - - -			1
Stone, Hannah, - - - - -			1
Stone, Robert, - - - - - Newspapers,			
Stone, William S., - - - - - Circulars,			34
Sydney, Linnean Society of New South Wales, - -			1
Sydney, Royal Society of New South Wales, - - -			1
Tacoma, Washington State Historical Society, - -			1
Taunton, Old Colony Historical Society, - - -			1
Taunton, Somersetshire Archæological and Natural History Society, - - - - -			1
Topeka, Kansas Historical Society, - Newspapers,			
Toronto, Canadian Institute, - - - - -			1
Trask, William B., - - - - -			1
Trenton, N. J., Microscopical Publishing Company, -			1
Trenton, New Jersey Natural History Society, - -			1
Tromso Museum, - - - - -			2
Turner, Mary E., Detroit, Mich., - Newspaper,			
Turner, Ross, - - - - -	2		1
U. S. Board on Geographic Names, - - - - -			1
U. S. Bureau of Education, - - - - -			5
U. S. Bureau of Ethnology, - - - - -	5		1
U. S. Bureau of Navigation, - - - - -			1
U. S. Chief of Engineers, - - - - -			6
U. S. Chief of Ordnance, - - - - -			2
U. S. Chief Signal Officer, - - - - -			1
U. S. Civil Service Commission, - - - - -			3
U. S. Coast and Geodetic Survey, - - - - -			2
U. S. Commissioner of Patents, - - - - -			1
U. S. Commissioner of Pensions, - - - - -			1
U. S. Comptroller of Currency, - - - - -			1
U. S. Department of Agriculture, - - - - -			5
U. S. Department of Interior, - - - - -	149		2
U. S. Department of State, - - - - -	4		21
U. S. Director of the Mint, - - - - -			1
U. S. Fish Commission, - - - - -			1
U. S. Geological Survey, - - - - -	8		11
U. S. Judge-Advocate-General, - - - - -			1
U. S. Life Saving Service, - - - - -			1
U. S. Light-House Board, - - - - -			2

U. S. National Museum, - - - . - - -	4	
U. S. Naval Observatory, - - - - -	2	
U. S. Patent Office, - - - - -		55
U. S. Quartermaster-General, - - - - -	1	
U. S. Secretary of the Treasury, - - - - -	1	
U. S. Surgeon-General's Office, - - - - -	1	
U. S. War Department, - - - - -	15	4
U. S. Weather Bureau, - - - - -		1
Upham, William P., Newtonville, - - - - -	30	405
Upsala, Kongliga Vetenskaps-Societeten, - - - - -	1	
Waites, Alfred, Worcester, - - - - -		1
Waite, Mrs. Edward O., Malden, - - - - -	83	
Waltham, Massachusetts School for the Feeble-Minded		1
Ward, Mrs. Mary G., - - - - -		2
Waring, Chapman and Farquhar, Newport, R. I., -		1
Washington, Anthropological Society, - - - - -		4
Washington, Smithsonian Institution, - - - - -		4
Waters, David P., - - - - -	31	49
Waters, Henry F., - - - - - Newspapers,	34	199
Waters, Joseph G., Estate of, - - - - -	7	26
Waters, Mrs. S. F., - - - - -		6
Waterville, Me., Colby University, - - - - -		2
Watson, Miss C. A., No. Andover, - - - - -	3	14
Watson, S. M., Portland, Me., - - - - -		1
Webster, John, Estate of, - - - - -	10	
Welch, William L., . - - Newspapers and Maps,	11	79
Wheatland, Henry, - - - - -	426	5
Whipple, George M., - - - - - Newspapers,	1	4
Whipple, Prescott, - - - - - Newspapers,		37
Wien, K. K. Zoologisch-Botanische Gesellschaft, - -		4
Wiesbaden, Nassauischer Verein für Naturkunde, -		1
Willson, Rev. E. B., - Newspapers and Circulars,	11	234
Winnipeg, Can., Historical and Scientific Society of Manitoba, . - - - - -		6
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Worcester, Society of Antiquity, - - - - -		3
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- - - - - Newspapers and Circulars,		79
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Youmans, W. J., New York, N. Y., - - - - -		11
Zurich, Naturforschende Gesellschaft, - - - - -		1

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American Journal of Education.	Musical Record.
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American Naturalist.	Naturalists' Leisure Hour and Monthly Bulletin.
Beverly Citizen.	Nature.
Cape Ann Advertiser.	New England Magazine.
Chicago Journal of Commerce.	Open Court.
Danvers Mirror.	Peabody Press.
Georgetown Advocate.	Peabody Reporter.
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Home Market Bulletin.	Salem News.
Iowa Churchman.	Salem Observer.
Ipswich Chronicle.	Salem Register.
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